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Wilmot Proviso to Zygote

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**WILMOT PROVISIO**, wíl môt prô-ví-zô, an amendment offered in the United States Congress by David Wilmot (q.v.), Aug. 8, 1846, pending the consideration of a bill placing \$2 million at the disposal of President James K. Polk to negotiate a peace with Mexico. The amendment, which was derived from the Northwest Ordinance, advocated the prohibition of slavery in any territory acquired from Mexico. It was adopted in the House in 1846, but the Senate adjourned without acting upon it. During the next session in 1847, the appropriation with the attached Proviso was again passed by the House and presented to the Senate where it was defeated primarily through the opposition of John C. Calhoun and other members of the Senate who advocated the extension of slavery in the South. A second appropriation of \$3 million without an amendment was passed instead.

Although the Proviso was never acted upon, it managed to pinpoint the sectional differences of the country, and subsequently laid the foundation for the Republican Party which adopted its principle concerning slavery. The amendment caused intense rivalries in the nation, and the issue involved became one of the main causes of the Civil War.

The reasons for submitting the Proviso are not entirely clear, but it was supported by those who feared the power of the South; by those who were opposed to slavery morally; by the disgruntled Democrats who felt the South had betrayed them concerning the Oregon boundary compromise; and by those who wished to oppose President Polk. Calhoun's opposition of the amendment was not unexpected, but his various resolutions maintaining that Congress had no say concerning the restriction of slavery in the territories increased Northern fears of the South and its motives.

See also VIRGINIA RESOLUTIONS, 1847.

**WILSON**, wíl'sən, **Alexander**, American ornithologist: b. Paisley, Renfrewshire, Scotland, July 6, 1766; d. Philadelphia, Pa., Aug. 23, 1813. He began working as a weaver's apprentice in 1779 and became a peddler in 1789. During this time he wrote many folk dialect poems, a volume of which, *Watty and Meg*, was published in 1792. Having also written a personal satire, Wilson was imprisoned for libel. Upon his release, he came to America. He taught school in Pennsylvania and New Jersey; became interested in ornithological work; and went on walking trips, which resulted in the publication of *The Foresters* (1805), a poem describing a journey to Niagara Falls.

At that time he was encouraged by William Bartram, the naturalist, and Alexander Lawson, the engraver, in his studies and drawings of North American birds. He wrote the classic, *American Ornithology*, seven volumes of which appeared between 1808 and 1813. Two subsequent volumes were edited posthumously by a friend of Wilson's, George Ord, and four others were published by Charles Lucien Bonaparte from 1825 to 1833.

**WILSON**, **Alexander**, Scottish astronomer: b. St. Andrews, Scotland, 1714; d. Edinburgh, Oct. 18, 1786. He studied at the University of St. Andrews and received his M.A. on May 8, 1733. In 1737 he became an assistant to an apothecary in London, and in 1742 he went back to St.

Andrews and started a letter foundry there. Wilson was appointed first professor of practical astronomy at the University of Glasgow in 1760, and in 1774 he published his unusual discovery pertaining to sunspots in *Philosophical Transactions* of the Royal Society of London. He maintained that sunspots are depressions in the matter surrounding the sun, and he proved his theory by a process of induction. Wilson was noted for his scientific investigations and for his work on the production and improvement of printing types.

**WILSON**, **Charles Edward**, American industrialist and government official: b. New York, N.Y., Nov. 18, 1886; d. Bronxville, N.Y., Jan. 3, 1972. In 1899 he joined the shipping office of the Sprague Electrical Works, New York City. This organization became a subsidiary of the General Electric Company in 1903, Wilson continuing with the company and rising through various departments to become merchandising manager and vice president (1930-1937). He was executive vice president from 1937 to 1939 and president in 1940-1942 and 1944-1950.

From 1942 to 1944 he served first as vice chairman and then as executive vice chairman of the War Production Board. He had charge of production scheduling for the war effort and procured materials for the atom bomb project. He resigned because he felt reconversion policies were being carried out too rapidly.

From December 1950 to March 1952 he was director of the Office of Defense Mobilization. As head of the defense program of the United States he urged adoption of price and wage controls to achieve economic stabilization. He resigned this post because of disagreement with President Harry S. Truman over settlement of a wage dispute in the steel industry.

**WILSON**, **Charles Erwin**, American industrialist and public official: b. Minerva, Ohio, July 18, 1890; d. Norwood, La., Sept. 26, 1961. He graduated from Carnegie Institute of Technology in 1909 as an electrical engineer. In the same year he began his career as an engineer with the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. In 1912 he designed the company's first automobile starting motor. From 1919 to 1926 he was chief engineer and factory manager for the Remy Electric Company, a General Motors subsidiary. Upon the reorganization of this company as the Delco-Remy Corporation, he became president and general manager, serving until 1929.

From 1929 to 1939 he was vice president of General Motors Corporation, concentrating on labor relations and production planning. Becoming president of the organization in 1941, he was one of the United States' leading defense production organizers during World War II. In 1947 he was author of the so-called "escalator" wage formula, a cost-of-living pay plan accepted by the automobile workers' union in 1948 as part of a five-year contract.

Wilson was named secretary of defense by the president-elect, Dwight D. Eisenhower, in 1952 and took office on Jan. 28, 1953. Holding office during a period of growing concern over the state of American military strength, he often faced criticism and was known for his bluntness in controversy. He stayed in the cabinet into the president's second term, resigning in 1957.

**WILSON, Charles Thomson Rees**, Scottish physicist: b. Glencorse, Midlothian, Scotland, Feb. 14, 1869; d. Carlisle, Peeblesshire, Nov. 15, 1959. Educated at Owens College (Manchester) and Sidney Sussex College (Cambridge) in England, he was professor of natural philosophy at Cambridge University from 1925 until his retirement in 1934. Beginning in 1895 he studied the condensation of tiny drops of water on gaseous ions, the properties of ionized particles, and the nature of atmospheric electricity. For his invention of the Wilson cloud chamber (q.v.), an instrument which made it possible to track electrons, and other subatomic particles, Professor Wilson (together with Professor Arthur H. Compton of the United States) was awarded the 1927 Nobel Prize in physics.

**WILSON, Edmund**, American critic and writer: b. Red Bank, N. J., May 8, 1895; d. Talcottville, N. Y., June 12, 1972. He graduated from Princeton in 1916, worked as a reporter in New York City, and served in the Army during World War I. In 1920-1921 he was managing editor of *Vanity Fair*. In 1926 he became book review editor of the *New Republic*, of which he had become associate editor by 1931, when he resigned to give more time to his writing, but remained a contributing editor. In the same year he published *Axel's Castle*, which was to become a standard text in the field of literary criticism as an analysis of the symbolist movement. Other subsequent works, such as *The Triple Thinkers* (1938), *The Wound and the Bow* (1941), and *The Shores of Light* (1952) brought further fame to Wilson as a critic. From 1944 to 1948 he served as book reviewer for the *New Yorker* magazine.

Besides poetry (*Poets, Farewell!*, 1929), a novel (*I Thought of Daisy*, 1929), plays (*Five Plays*, 1954), and short stories (*Memoirs of Hecate County*, 1946), Wilson also wrote about political matters. *Travels in Two Democracies* (1936) and *To the Finland Station* (1940) concern European revolutionary movements.

Some of Wilson's other work, such as *The Scrolls from the Dead Sea* (1955), has been very popular, but it is as a critic that he is most famous. *Patriotic Gore* (1962) concerns the literature of the American Civil War.

Wilson was awarded the Presidential Medal of Freedom in 1963, the National Medal for Literature in 1966, and the Aspen Award in 1968. A book of memoirs, *Upstate: Records and Recollections of Northern New York*, appeared in 1971.

**WILSON, Edmund Beecher**, American zoologist: b. Geneva, Ill., Oct. 19, 1856; d. New York, N.Y., March 3, 1939. Graduated from the Sheffield Scientific School at Yale University in 1878, he continued his studies at Johns Hopkins University and later in England, Germany, and Italy. In 1885 he was named professor of biology at the newly founded Bryn Mawr College in Pennsylvania. He joined the faculty of Columbia University six years later, and was Da Costa professor of zoology there from 1909 until his retirement in 1928. Beginning with studies in embryology, Wilson's researches extended to pioneer investigations in the field of cytology, leading to the publication of his classic work, *The Cell in Development and Inheritance* (1896, 3d ed. rev., 1925). He played a major part in promoting the theories of Gregor Mendel.

**WILSON, Halsey William**, American bibliographer and publisher: b. Wilmington, Vt., May 12, 1868; d. Yorktown Heights, N.Y., March 1, 1954. Educated at the University of Minnesota, he opened a bookstore at Minneapolis in 1889. Lacking a convenient bibliography of the American book trade, he initiated the *Cumulative Book Index* in 1898. This grew into a list of books in the English language, arranged alphabetically by author, title, subject, editor, translator, illustrator, and series in a single combined list. A new list was issued monthly, and these lists were periodically cumulated.

This trade bibliography was the foundation of the H.W. Wilson Company as the major bibliographical publisher in America. It was followed by a series of periodical indexes, beginning with *Reader's Guide to Periodical Literature* (1901) and extending to special subject indexes, and by other essential reference tools.

Wilson's major innovations in bibliographic publishing were his consistent cumulation of entries and his "service basis" for pricing. The service basis consisted of a sliding price scale for his bibliographies and indexes. Libraries with large collections and substantial book budgets paid higher prices than small libraries.

HOWARD W. WINGER.

**WILSON, Sir Harold** (1916– ), British prime minister from 1964 to 1970 and again from 1974 to 1976. James Harold Wilson was born on March 11, 1916, in Huddersfield, Yorkshire. He was educated at Wirral Grammar School and at Jesus College, Oxford University. After a brilliant undergraduate career, he went to Oxford's New College in 1937 as a lecturer in economics.

On the outbreak of World War II, he joined the civil service, and in 1943-1944 he served as director of economics and statistics in the ministry of fuel and power.

Although he had been a Liberal in his undergraduate days, Wilson turned to the Labour party as a result of his work on problems of unemployment and his contacts with the Fabian Society, an organization devoted to achieving socialism gradually. He was nominated as a Labour candidate for Parliament in 1944 and resigned from the civil service. Back at New College, he combined his research and practical experience in a book, *New Deal for Coal* (1945). He was elected to Parliament that year and was immediately included in the new Labour government, serving as parliamentary secretary to the ministry of works (1945-1947), secretary for overseas trade (1947), and president of the board of trade (1947-1951).

During the period 1945 to 1950, Wilson was regarded as a "right-wing ally" of the Labour leadership. In 1951 he resigned from the government because of cuts in welfare expenditure, and after the Labour party's defeat that year, he joined a left-wing group headed by Aneurin Bevan that opposed the leadership of Clement Attlee and, later, of Hugh Gaitskell. In 1960, Wilson challenged Gaitskell for the party leadership. Although he was defeated, his reputation survived and he won the leadership election in 1963, after Gaitskell died.

Labour's victory in 1964 installed Wilson as prime minister. In 1966, in a bid to increase his party's slim margin in the House, Wilson called for new elections, and this time Labour won a commanding 97-seat majority. He suffered



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Sir Harold Wilson, British statesman and leader of the Labour party, was twice Britain's prime minister.

an unexpected electoral defeat in 1970, but, although losing office to the Conservatives, retained authority within his own party. Labour's narrow victory at the polls in February 1974 enabled Wilson to return as head of a minority government.

On March 16, 1976, Wilson surprised the nation by resigning. He had served as party leader for 13 years and as prime minister for nearly 8 years. On April 22, 1976, Queen Elizabeth II named him a Knight of the Garter.

**WILSON, Henry**, American political leader, who was vice president of the United States from 1873 to 1875: b. Farnington, N.H., Feb. 16, 1812; d. Washington, D.C., Nov. 22, 1875. His name, originally Jeremiah Jones Colbath, was legally changed in 1833. As a young man he operated a shoe factory at Natick, Mass., and was elected to the lower house of the Massachusetts legislature in 1840.

An opponent of slavery, Wilson left the Whig party, moving first to the Free Soil party and then to the new Republican party, which he helped organize. Wilson represented Massachusetts in the U.S. Senate from 1855 to 1873. During the Civil War he headed the important Senate committee on military affairs, and after the war he took a prominent part in reconstruction measures favoring full civil and political rights for Negroes. Elected vice president with Ulysses S. Grant in 1872, Wilson suffered a stroke in 1875 and died in office.

**WILSON, Sir Henry Hughes**, British army officer: b. Edgeworthstown, County Longford, Ireland, March 5, 1864; d. London, England, June 22, 1922. Commissioned in 1884, he saw active service in Burma and the South African War. He was commandant of the Army Staff College from 1907 to 1910. Thereafter he was director

of military operations until the outbreak of World War I in 1914 when he went to France as assistant chief of staff to Sir John Denton Pinkstone French. He was later a corps commander, then chief liaison officer with the French supreme command; and after a period in Britain commanding the Eastern division, he visited Russia in 1916 with the mission headed by Lord Alfred Milner. In 1917 Wilson returned to France as British military representative on the newly established Supreme War Council, and the next year he became chief of the British general staff. With the war's end he was promoted field marshal and created baronet, and after leaving the army in 1922, he was elected member of the House of Commons for North Down, Ireland. His advocacy of strong measures in Ireland against the Sinn Fein, an Irish nationalist organization, resulted in his assassination by two members of the Sinn Fein.

**WILSON, Henry Maitland, 1st Baron Wilson of Libya and of Stowlangtoft**, British army officer: b. Stowlangtoft Hall, Suffolk, England, Sept. 5, 1881; d. Aylesbury, England, Dec. 31, 1964. He served in the South African War and World War I, and rose through the grades to become brigadier in 1934. The following year, promoted to major general, he commanded Britain's first fully mechanized brigade; and in 1939, with the rank of lieutenant general, he was sent to Egypt to command the Army of the Nile. In 1940, after France's surrender in World War II, he directed the operations which extended the British front into Libya, and early in 1941 became military governor of Cyrenaica. He was shortly sent from North Africa to Greece and, following the evacuation of British troops from that country, he was given command of the forces in Palestine and Transjordan. Promoted full general, late in 1941 he conducted a five-week campaign in collaboration with Free French forces which resulted in the capture of Damascus and retention of Syria for the Allied cause.

Early in 1942 he was appointed commander in chief of the new Iran-Iraq Command, responsible for guarding one flank of the Suez Canal, and in February 1943, he replaced Gen. Sir Harold R. L. G. Alexander as commander in chief of the Middle East. In 1944 he became supreme allied commander in the Mediterranean theater in succession to Gen. Dwight David Eisenhower. He was also named to supreme command in western Europe, and in this capacity he directed the campaign in Italy. He was promoted to the rank of field marshal in 1944, and from 1945 to 1947 he was in Washington, D.C. as head of the British joint staff mission. In this post he was the senior British member of the combined chiefs of staff, an Anglo-American organization which was not dissolved with the termination of World War II. In recognition of Wilson's services he was knighted in 1940 and created baron in 1946. He is author of *Eight Years Overseas, 1939-1947* (1950).

**WILSON, James**, American statesman and Supreme Court justice: b. Carskerdo, Scotland, Sept. 14, 1742; d. Edenton, N.C., Aug. 21, 1798. Educated at the universities of St. Andrews, Glasgow, and Edinburgh, he arrived in New York City in 1765. The next year he moved to Philadelphia, Pa., taught Latin at the College of Philadelphia, and studied law. He was admitted to the bar in 1767.

In 1774 he was a delegate to the First Continental Congress. In 1774 he distributed what was to become an extremely important manuscript, *Considerations on the Nature and Extent of the Legislative Authority of the British Parliament*. In this publication Wilson maintained that the British Parliament had absolutely no power over the colonies, which were bound to England only by the authority of the king. Each colony, he went on to say, was a separate and independent self-governing unit. This Federalist doctrine was in advance of the political theories of the day.

In 1775 Wilson was a member of the Pennsylvania Provincial Congress, where he made a speech asserting the possibility of an unconstitutional act by Parliament. This idea was the forerunner of the American policy of judicial review. Later in the same year he was elected to the Second Continental Congress, which met for the purpose of accepting the necessity for war and the Declaration of Independence, of which he was a signer. Wilson, belonging as he did to one of the Middle States, where opinions differed sharply about the situation, was reluctant at first to declare independence. However, his vote broke the deadlock of the Pennsylvania delegation, and Pennsylvania voted for independence.

Wilson was a member of the Continental Congress until 1777 and again in 1783 and 1785-1786. He exerted great influence at the Constitutional Convention of 1787, which assembled for the purpose of writing a constitution that would safeguard the individual states and yet provide a system of authority between the central government and the separate states. Wilson was an important member of this distinguished group, which went far beyond its original purpose of revising the Articles of Confederation, and created the Constitution of the United States. At this time Wilson was the only man who urged election of senators by the direct vote of the people rather than by state legislatures. His belief in natural rights, a doctrine maintaining that sovereignty rests in the individual rather than in government, is reflected in the measures he suggested at this time. He signed the Constitution and fought for its adoption at the Pennsylvania ratifying convention. He became the first professor of law at the University of Pennsylvania in 1789, and in the same year was appointed to be one of the first associate justices of the Supreme Court of the United States. His involvement in land speculation caused him financial difficulties, and he was jailed for his debts. He served on the Supreme Court until his death in 1798.

**WILSON, James Falconer**, American lawyer and politician: b. Newark, Ohio, Oct. 19, 1828; d. Fairfield, Iowa, April 22, 1895. In 1852 he moved to Fairfield with his family, where he practiced law. He served in both houses of the Iowa state legislature, becoming president of the Senate in 1861. He was a member of Congress from 1861 to 1869 where, as chairman of the judiciary committee he vigorously supported anti-slavery measures. In 1868 he was one of the managers of the impeachment proceedings against Andrew Johnson, on the grounds that Johnson failed to abide by the acts of Congress. From 1882 until his death, Wilson was a member of the United States Senate. He sponsored the original package act in 1890, which provided state control of liquor transportation.

**WILSON, James Harrison**, United States army officer: b. Shawneetown, Ill., Sept. 2, 1837; d. Wilmington, Del., Feb. 23, 1925. Graduated from West Point in 1860, he joined the engineer corps, and following the outbreak of the Civil War the next year, he took part in the Battle of Port Royal Bay. He also participated in other major Civil War campaigns such as Antietam, Chattanooga, the Wilderness, Shenandoah, and Nashville. In March 1865, he made a raid into Alabama and Georgia, capturing Selma, Montgomery, Columbus, and Macon in 28 days, as well as capturing Jefferson Davis. He resigned from the army in 1870, but he decided to join again at the outbreak of the Spanish-American War in 1898. He served as second in command during the Boxer Rebellion in China. Wilson retired for a second time in 1900, having achieved the rank of brigadier general. Among his publications are biographies of Ulysses Grant (with Charles Anderson Dana, 1868), and Charles Anderson Dana (1907).

**WILSON, John** (pseudonym CHRISTOPHER NORTH), Scottish author: b. Paisley, Scotland, May 18, 1785; d. Edinburgh, April 3, 1854. He was educated at Glasgow University and Magdalen College, Oxford. At the time of his graduation in 1810, Wilson had come into a considerable amount of money. He subsequently retired to a property he had purchased at Elleray on Windermere to live as a country gentleman, writing poetry.

In 1812 Wilson published the once-famed *Isle of Palms*; another poem in dramatic form, *The City of the Plague* (1816), was still more successful, but is now forgotten. In 1815, however, he lost his fortune through the fraudulent speculation of an uncle, and in 1817, together with John Gibson Lockhart, became connected with *Blackwood's Magazine*. This Tory-slanted and intellectually aggressive magazine gained great popularity. Among Wilson's many articles printed in this journal was his renowned *Noctes Ambrosianae*, a series of conversations on a number of general subjects including literary, political and philosophical issues, written as though they had taken place between contributors to *Blackwood's* at convivial meetings in Ambrose's Tavern, Edinburgh. The articles in this series first appeared in 1822, and from 1825 to 1835, when they ended, were written almost solely by Wilson.

In 1820 Wilson obtained the chair of moral philosophy in the University of Edinburgh, a post for which he had few qualifications, but which he nevertheless filled with credit for 31 years. An incomplete edition of his works, edited by J. F. Ferrier, was published in 12 volumes (Edinburgh 1855-1858). In addition, he published a complete edition of the *Noctes Ambrosianae*, edited by R. S. Mackenzie, in five volumes (New York 1866).

**WILSON, Robert**, English comic actor and playwright: d. 1600. The place and date of his birth are unknown. He was one of the actors who comprised the earl of Leicester's company when it was formed in 1574, and soon made a reputation as a comedian equal or second only to Richard Tarlton. Wilson was famous for his ability to extemporize, and his ready and facile wit. From 1583 to 1588 he was one of the 12 players who comprised Queen Elizabeth's com-



pany, and afterward joined the lord chamberlain's company, of which William Shakespeare also became a member.

The three morality plays—a genre of drama which personifies vices and virtues—generally assigned to Wilson are: *Three Ladies of London* (1584); *The Pleasant and Statelie Morall of the Three Lordes and Three Ladies of London* (1590); and *The Cobblers Propheste* (1594). One episode of the *Three Ladies of London* concerns a Jewish creditor attempting to recover a debt from an Italian merchant, undoubtedly a forerunner of Shakespeare's *Merchant of Venice*.

**WILSON, Samuel** ("UNCLE SAM"), American patriot and merchant: b. Menotomy (now Arlington), Mass., Sept. 13, 1766; d. Troy, N.Y., July 31, 1854. His father, Edward Wilson, and older brothers, Joseph and Edward, Jr., fought in the American Revolution. Sam himself ran away from home at the age of 14 to enlist in the American Army and served until the end of the war. At 23, almost penniless, he moved to Troy, N.Y., where in 1790 he began a meat-packing business. By dint of hard work he took root in the community and became known for his honesty and common sense. By the beginning of the War of 1812, Wilson had become prominent in New York State, and in September 1812 he was made inspector of provisions for the United States Army in New York and New Jersey. A group of visitors to his plant in Troy on Oct. 2, 1812, including Gov. Daniel D. Tompkins of New York, asked what the initials "EA-US" on the barrels of meat stood for. A workman replied that "EA" stood for Elbert Anderson, Jr., the contractor for whom Wilson worked, and added jokingly that the "US" (actually an abbreviation for "United States") stood for "Uncle Sam" Wilson. An eyewitness account of this incident was recorded by the former Congressman Theodorus Bailey, then postmaster of New York City and one of the group of visitors, in the May 12, 1830, issue of the *New York Gazette and General Advertiser*. The allusion caught on rapidly, for Wilson was popular and seemed to epitomize the plain American—honest, self-reliant, and devoted to his country. By the close of the War of 1812 the sobriquet "Uncle Sam" had come to symbolize the national character and the government. In 1961 Congress adopted a resolution saluting "Uncle Sam" Wilson of Troy, N.Y., as "the progenitor of America's national symbol." Wilson is buried in Oakwood Cemetery in Troy.

THOMAS I. GERSON.

**WILSON, Samuel Alexander Kinnier**, British neurologist: b. Cedarville, N.J., Dec. 6, 1877; d. London, England, May 12, 1937. His father was an Irish clergyman temporarily living in New Jersey. Wilson was educated at Edinburgh University, and following his graduation in 1903, studied in Paris (1903–1904), and in Leipzig, and in 1904 became resident medical officer at the National Hospital for the Paralyzed and Epileptic in London. He was associated with this institution until his death, and was junior neurologist at King's College Hospital from 1919; senior neurologist there, from 1928. Wilson's disease, or Wilson's syndrome, is a name given to hepatolenticular degeneration, a progressive degeneration of the lenticular nucleus of the brain associated with cirrhosis of the liver, which he described in 1912.

Wilson was a brilliant writer, theoretician, and teacher. He was a member of neurological societies throughout the world. In 1920 he founded and became the first editor of the *Journal of Neurology and Psychopathology*. His published works include *Aphasia* (1926); *Modern Problems in Neurology* (1928); and *Neurology*, edited by Alexander Bruce, 2 vols. (1940).

**WILSON, Thomas Woodrow**. See WILSON, WOODROW.

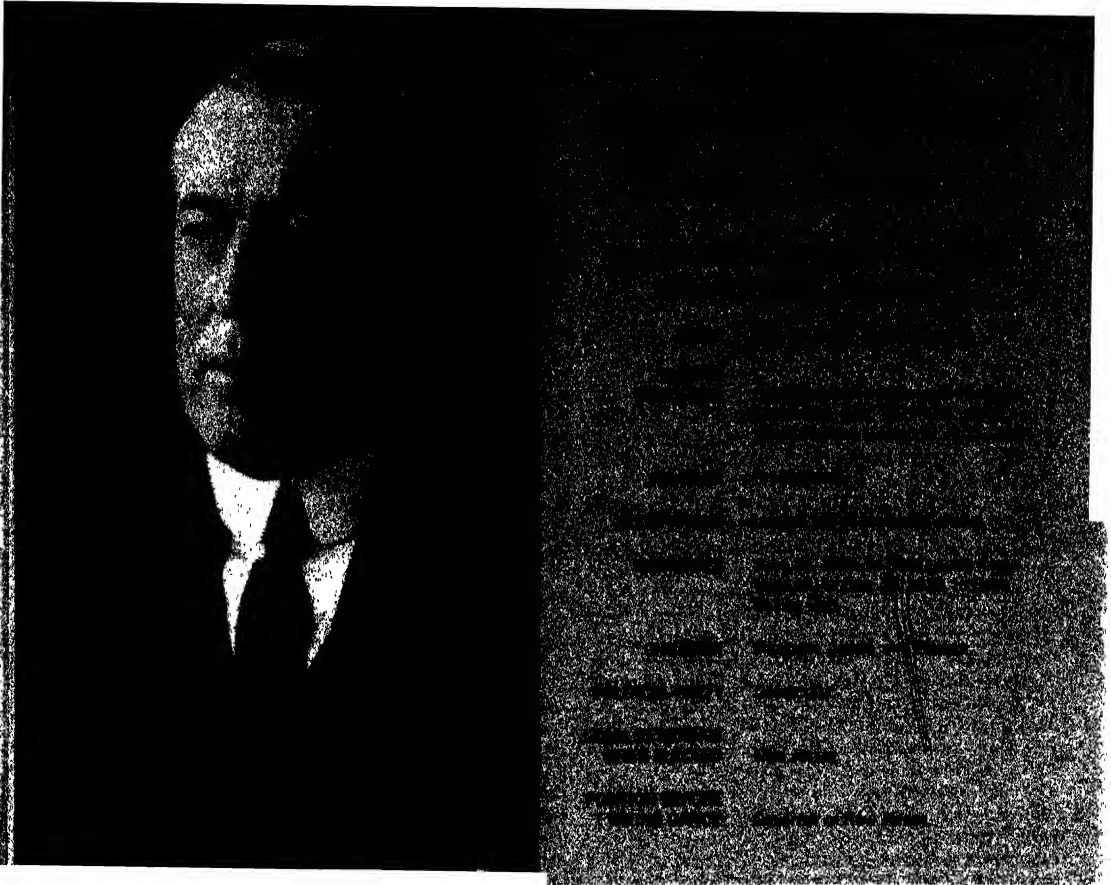
**WILSON, William Bauchop**, American labor leader and public official: b. Blantyre, Scotland, April 2, 1862; d. Savannah, Ga., May 25, 1934. He accompanied his family to the United States in 1870 and in the next year, at the age of nine, went to work in the coal mines at Arnot, Tioga County, Pa. In the 1880's and 1890's he was often forced into other work due to his ardent unionism. From 1888 to 1890 he was president of the district miners' union, and in the last-named year was one of the founders of the United Mine Workers of America, which he served as secretary-treasurer from 1900 to 1908. He was active in the coal strikes of 1899 and 1902.

In 1907 he was elected to the House of Representatives as a Democrat, serving until 1913, when he was appointed to President Woodrow Wilson's cabinet as the nation's first secretary of labor. While in Congress, Wilson was chairman of the House committee on labor and helped to organize the federal Bureau of Mines in 1910. As secretary of labor he made significant contributions in the field of labor welfare, methods of mediation, and collective bargaining.

**WILSON, William Lyne**, American legislator and educator: b. Middleway, Va. (now in West Virginia), May 3, 1843; d. Lexington, Va., Oct. 17, 1900. He graduated from Columbian College (now George Washington University), Washington, D.C., in 1860, and studied at the University of Virginia until 1861, when he enlisted in the Confederate cavalry, with which he served throughout the Civil War. From 1865 to 1871 he was assistant professor of ancient languages at Columbian College where he studied law simultaneously. He was admitted to the bar in 1869, and in 1871 began practicing at Charles Town, W.Va.

Wilson was president of the University of West Virginia from 1882 to 1883, and from 1883 to 1895 was a member of the House of Representatives, distinguishing himself as a leader in the movement to reduce tariffs, which resulted in a tariff reform bill in 1894. This Wilson tariff bill provided for the free importation of wool and other commodities, and levied an income tax, but the bill was so changed and weakened in the Senate due to the influence of tariff lobbyists that President Grover Cleveland let it become law without signing it.

Following his defeat for reelection in 1894, Wilson was appointed postmaster general by President Cleveland. He served in this position from 1895 to 1897, during which time he inaugurated rural free delivery and made other improvements in the postal system. A firm believer in the gold standard, he vigorously opposed William Jennings Bryan in 1895–1896. From 1897 until his death Wilson was president of Washington and Lee University.



**WILSON, (Thomas) Woodrow**, 28th president of the United States: b. Staunton, Va., Dec. 28, 1856; d. Washington, D.C., Feb. 3, 1924. He was the son of Joseph Ruggles Wilson, who was the pastor of the Presbyterian Church in Staunton, Va. The elder Wilson accepted a call to Augusta, Ga., in 1857. "My earliest recollection," Woodrow Wilson said long afterward, "is of standing at my father's gateway in Augusta, Georgia, when I was four years old, and hearing someone pass and say that Mr. Lincoln was elected and there was to be war." Joseph Ruggles Wilson, a strong southern sympathizer even though he had grown up in Ohio, was a chaplain in the Confederate Army. His son saw only the backwash of war, but he never forgot its terror or the lessons that it taught.

**Early Life and Manhood, 1870-1902.**—The Wilsons moved to Columbia, S.C., in 1870, when Dr. Wilson accepted a professorship at the Columbia Theological Seminary. Columbia was still partly a burned ruin, and Radical Republicans ruled in the state capitol. But life was remarkably normal for the growing boy. He learned much from his brilliant father, continued his schooling, and joined the church in 1873. The following autumn he entered Davidson College in North Carolina. Because of illness Wilson stayed with his family in Wilmington, N.C., to which they had just moved, during 1874 and part of 1875. In September 1875 he entered the College of New Jersey, now Princeton University. He was a conscientious if not brilliant student (he stood midway in his class), and he read widely in the classics and fell in love with history. An ardent debater, he also wrote for college magazines.

Having resolved to become a "statesman," Wilson entered the Law School of the University of Virginia in the autumn of 1879, but had to withdraw after a physical breakdown in December 1880. After study at home, he opened a law office in Atlanta in June 1882. Admitted to the bar a few months later, he did not prosper. In despair he entered the Johns Hopkins University in Baltimore in September 1883 to prepare himself for a career in teaching. Among a remarkable group of scholars Wilson did distinguished work, and wrote his first book, *Congressional Government* (1885), analyzing the weaknesses of leadership in the American constitutional system. This was his dissertation for the doctor's degree which was awarded him in 1886. On June 24, 1885, he married Ellen Louise Axson in Rome, Ga. It was a happy marriage blessed by three daughters.

Wilson accepted an associate professorship of history at Bryn Mawr College near Philadelphia in 1885. He was not happy at this woman's college, and he accepted a professorship at Wesleyan University in Connecticut in 1888 with an alacrity that betrayed his yearning for a "class of men." At Wesleyan he was an immediate success. He published a major work in comparative government, *The State*, in 1889 and coached one of the most successful football teams in Wesleyan's history. But he could not refuse the call to a professorship from Princeton when it came in 1890.

Everything seemed to work together to make the 12 years of Wilson's professorship at Princeton a time of rich fulfillment. He grew notably in scholarly maturity, publishing *Division and Reunion* (1893), a pioneer study of the American Civil War; his largest work, *History of the Ameri-*

*can People* (1902); and other books and essays as well. He was a regular lecturer at Johns Hopkins during most of this period, and at least seven times he was offered the presidency of universities. As a teacher and faculty colleague he was an unrivaled success. When the trustees of Princeton virtually deposed the president, the Reverend Dr. Francis L. Patton, in 1902, they turned unanimously to Wilson. He was the first layman ever chosen to the presidency of the university.

**President of Princeton University, 1902-1910.**—Wilson was inaugurated with becoming pomp at Princeton on Oct. 25, 1902. He was a striking figure in his gown. His height and build were average, but his rectangular face, with its jutting jaw and flashing eyes, radiated power and reflected quick intelligence. In his mature personality Wilson was at once simple and complex. He had a quick and orderly mind and a rare ability to cut through the maze of details to the essence of a subject. Among his family he was affectionate, and went far beyond the call of duty in supporting and helping to educate indigent kinsfolk. He was utterly dependent upon love and friendship, but he perhaps demanded too much of friends and did not take lightly what he regarded as betrayal of trust. But throughout his life he drew his greatest strength from the resources of Christian faith. A Presbyterian elder, he had a superb command of Reformed theology, read the Bible daily, and attended divine services regularly. It was no accident that he never thought about public matters, as well as private ones, without first trying to decide what faith and Christian love commanded in the circumstances.

All his adult life Wilson had been fascinated by the problems of leadership in the American and British political systems. Now he resolved to lead trustees and faculty in a drive to make "in fact a great university" out of a run-down college. First came a radical change in the method of instruction with the addition of some 50 young scholars to launch what Wilson called the preceptorial system. It supplemented course lectures with discussion conferences conducted by preceptors. At the same time, Wilson took the lead in thoroughgoing reorganization of the university's curriculum. Completed in 1904, it assured considerable integration of fields of study without, however, denying some choice to undergraduates. Along with these changes went a noticeable improvement in academic standards.

From 1906 to 1907 Wilson moved to his next objective: the reorganization of undergraduate social life, by proposing to abolish upperclass eating clubs, which had become centers of college activity; and to group students in residential quadrangles, each with its dining hall, common room, and faculty fellows. Although Wilson did not attack the clubs in their most vulnerable spot—their reputation for exclusiveness—he evoked such violent opposition from alumni and students that the trustees quickly withdrew the approval they had tentatively given. Wilson did not take defeat meekly. He nearly resigned when a committee of the trustees buried the quadrangle plan in a final report early in 1908.

The next two years were marked by increasing turmoil at Princeton. The ostensible issue was the location of a new graduate college. The dean of the Graduate School, Andrew F. West, wanted to build the college at some distance from the campus; Wilson insisted that it should be located in the center of the university. The real cause of

conflict was personal antagonism, and Wilson was right in thinking that West meant to build his own empire. In 1909 Wilson persuaded the trustees to decline one gift of a graduate college to be built on West's terms. But he was helpless when an alumnus died in 1910, leaving between \$2 to \$4 million to carry out West's plans.

**Governor of New Jersey, 1911-1913.**—In the spring of 1910, Col. George Harvey, editor of *Harper's Weekly*, persuaded James Smith, "boss" of the New Jersey Democratic Party, to support Wilson for the gubernatorial nomination. In despair over West's recent triumph, Wilson agreed to accept the nomination if it were offered without conditions. Smith's well-oiled machine worked perfectly, but his plan to elect a dignified puppet soon went awry. Wilson accepted the Democratic state convention's nomination, aligned himself with the progressive forces that had been fighting Smith, and won in a landslide on Nov. 8, 1910. It was only the beginning of the revolution. Before his inauguration Wilson prevented Smith's election to the United States Senate by the state legislature. Inaugurated on Jan. 17, 1911, the new governor maintained such heavy pressure on the legislature at Trenton that he won enactment of most of his program in one session: direct primaries; effective state regulations of public utilities; workmen's compensation; municipal reform; and reorganization of the school system. In early 1913 he won the last of his important demands—antitrust legislation to drive industrial monopolies from New Jersey.

These triumphs made Wilson a leading contender for the Democratic presidential nomination in 1912. He worked hard, but his cause seemed hopeless when the Democratic national convention opened in Baltimore, Md., on June 25, 1912. Champ Clark of Missouri, speaker of the House of Representatives, commanded nearly a majority of the delegates, while Representative Oscar W. Underwood of Alabama had drawn off some 100 delegates who would otherwise have gone to Wilson. Clark achieved a majority on the 10th ballot, but not the necessary two thirds, when Tammany swung New York into his column. On the 14th ballot, William Jennings Bryan, Democratic leader from Nebraska, switched his vote from Clark to Wilson. This dramatic move did not turn the tide, but Wilson gained slowly. He won the nomination on the 46th ballot with the help of the Underwood men.

The ensuing presidential campaign was filled with excitement and drama. President William Howard Taft, the Republican nominee, had no chance and knew it. But Theodore Roosevelt, who had entered the race at the head of the third-party Progressive ticket, campaigned with great vigor. He called for a New Nationalism looking toward sweeping extension of federal regulation and welfare activity. Wilson countered with what he called the New Freedom—a program to liberate American economic energies by drastic tariff reduction, strengthening of anti-trust laws and reorganization of the banking and credit system. Wilson won 435 electoral votes out of 531, and carried a Democratic Congress into office on Nov. 5, 1912, but he polled only 42 percent of the popular vote.

**The New Freedom, 1913-1914.**—It was not easy for the leader of a party that had been out of power for 20 years to build an administration from the ground up. The chief cabinet post, the secretaryship of State, went to Bryan. The ap-



pointment of other party regulars signified that Wilson would work through established machinery instead of a bipartisan progressive coalition. However, Wilson lost no time after his inauguration on March 4, 1913, in demonstrating that he meant to use all his power as president and party leader. He called Congress into special session to redeem his first promise of tariff reform. Appearing in person before a joint session on April 8, he broke a century-old precedent and emphasized his determination to lead in legislation. The battle that followed was the crucial test of Wilson's domestic leadership. A tariff reform bill, sponsored by Representative Underwood, passed the lower house easily enough, but dangers in the Senate threatened emasculation if not defeat of the Underwood bill. Just when it seemed that it would go the way of earlier tariff reform measures, Wilson launched a bold attack—by charging that an industrious and insidious lobby was trying to defeat honest tariff legislation. Democratic opposition in the Senate melted. The Underwood Act, approved Oct. 3, 1913, was the first tariff legislation uninfluenced by special interests since the Civil War. It greatly enlarged the free list, reduced general rates from a level of about 40 percent to 26 percent, and imposed the first income tax under the 16th Amendment.

Meanwhile, Wilson had already begun his campaign for badly needed currency and banking reform. Working with Representative Carter Glass of Virginia, the president hammered out the Federal Reserve bill. It established 12 Federal Reserve banks to perform central banking functions. Coordinating and controlling the entire system was a Federal Reserve Board of presidential appointees. The measure also created a new currency, Federal Reserve notes, issued by Federal Reserve banks against gold and commercial credits. The House approved the bill on Sept. 18, 1913, but Wilson won Senate approval on December 19 only after a hard fight against private banking interests.

Only antitrust reform remained to complete the New Freedom program. At the outset of the debate over proposals in early 1914, Wilson still thought that clarification of the Sherman Act would suffice. But he was soon persuaded to adopt another solution. He lost interest in his first measure, the so-called Clayton Antitrust bill. However, Congress approved it, with a meaningless amendment saying that labor unions were not illegal combinations in restraint of trade; and Wilson signed the measure on Oct. 15, 1914. Meanwhile, he had concentrated on his new solution, the Federal Trade Commission bill. It outlawed "unfair" trade practices in sweeping terms, and created a Federal Trade Commission to issue "cease and desist" orders to prevent unfair competition. This measure, which heralded a new era of governmental regulation, received Wilson's signature on Sept. 26, 1914.

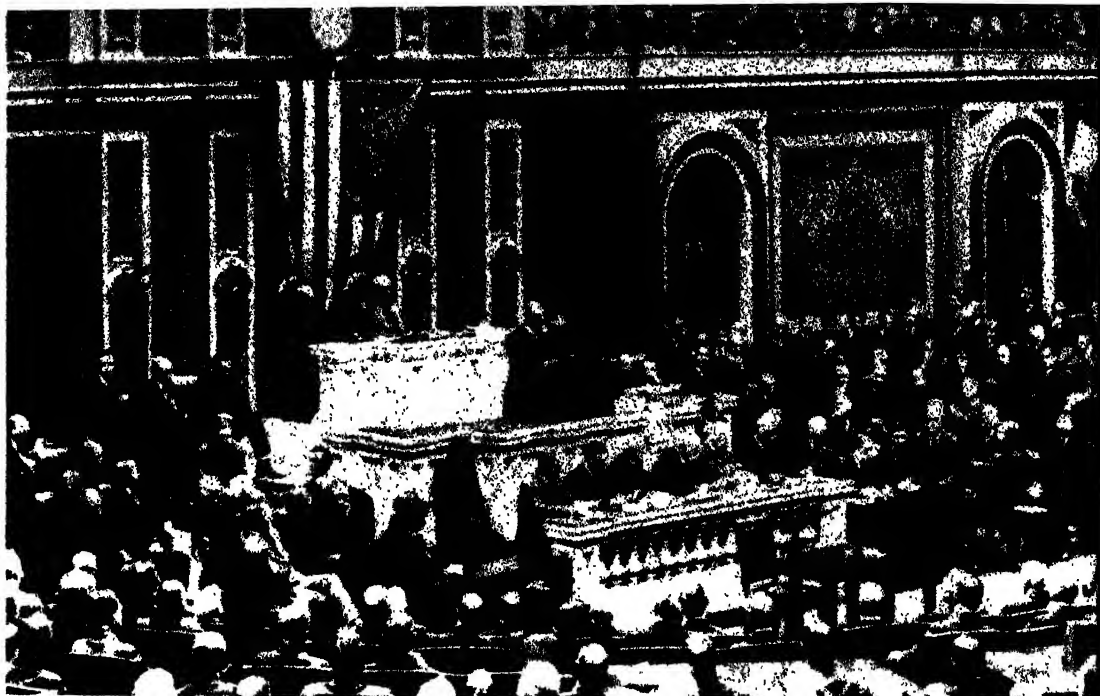
Foreign relations were a constant source of perplexity during Wilson's first two years in office. Both he and Secretary Bryan hoped to inaugurate a new foreign policy of helpfulness. They signed treaties with 30 nations providing for investigation of disputes that might lead to conflict. But goodwill alone did not suffice to settle other problems. They negotiated a treaty with Colombia to repair the damage done by Theodore Roosevelt's complicity in the Panamanian revolution of 1903, only to have the treaty rejected by the Senate. They were unable

to persuade the California legislature to avoid insult to Japan in legislation to prevent Oriental ownership of land. In Nicaragua, Haiti, and the Dominican Republic they pursued policies of helpfulness that led, in the case of the last two countries, to forcible military occupation in 1915 and 1916.

The New Freedom abroad met its severest challenge in Mexico. In February 1913 Victoriano Huerta, head of the Mexican Army, deposed and arranged the murder of President Francisco Madero, and took power as acting president. Recoiling at the treachery, Wilson refused to accord formal recognition to Huerta. Then, during the summer of 1913, he sent a special agent to Mexico City with a plan for Huerta's retirement and the election of a new government. When Huerta refused and established a military dictatorship, Wilson supported Huerta's rivals, the Constitutionalists. Finally, using the momentary arrest of American sailors at Tampico as an excuse, Wilson, on April 21, 1914, ordered the Navy to occupy Veracruz. The operation went off on schedule, but not without bloodshed and the threat of full-scale war. Wilson accepted the mediation offered by Argentina, Brazil, and Chile, but he did all he could to hasten Huerta's downfall. The Constitutionalists occupied Mexico City in August 1914, but Wilson's troubles were not over. His recognition of one Constitutionalist faction caused the leader of another, Francisco Villa, to sack Columbus, N.Mex. on March 9, 1916. Wilson sent a punitive expedition under Gen. John J. Pershing into Mexico in pursuit. Villa cleverly drew Pershing so deeply into the country that the Mexican government threatened war. A clash occurred at Carrizal, and Wilson drafted a war message. But reason prevailed, and war was miraculously averted. Wilson withdrew the expedition in January 1917.

**Neutrality and the Road to War, 1914–1917.**—Wilson's world was shattered by two tragedies in the summer of 1914—Mrs. Wilson's death on August 6, and the outbreak of general war in Europe a few days before. Americans disagreed about the causes and issues of the war, but virtually all of them wanted to remain outside its vortex. So also did Wilson and most of his advisers. The president not only proclaimed his government's official neutrality, but also appealed to Americans on August 18 to be "impartial in thought as well as in action." Difficulties arose first with the British, who used their sea power to control neutral trade in ways that sometimes stretched international law if they did not break it. The severest challenge came in February 1915, when the Germans announced that they would use submarines to destroy Allied merchantmen, and that neutrals might suffer as well. The British and French retaliated by declaring a total blockade against all commerce to and from Germany. The United States was caught in the cross-fire, and Wilson was prepared to make substantial adjustments. Then a submarine torpedoed the British liner *Lusitania* without warning on May 7, 1915, killing more than 100 Americans among others. Wilson warned that repetition of the sinkings would lead to war. After the torpedoing of the British liner *Arabic* on August 19, the German government gave the definite promise of safety for passenger ships that Wilson had demanded.

The *Arabic* pledge gave Wilson an opportunity to pursue a campaign for peace that he



BROWN BROTHERS

Wilson addresses Congress in February 1917 soon after Germany's resumption of unrestricted submarine warfare.

had begun the winter before. He sent Col. Edward M. House, his most intimate adviser, to London in January 1916 to explore the possibilities of peace through Anglo-American cooperation. Soon afterward Wilson pressed the German government hard on the issue of the safety of armed merchantmen, and fought off a congressional rebellion aimed at legislation to prevent Americans from traveling on armed ships. The issue came to a head when a submarine sank the English Channel packet *Sussex* on March 24. The president threatened to break relations with Germany, and the German government, on May 4, 1916, gave a sweeping pledge to follow 'conventional rules in attacking merchantmen.'

These events were prelude to the presidential campaign in the offing. Earlier it had seemed that preparedness would be the major issue. But Wilson had taken leadership in a moderate campaign, and during the spring of 1916 Congress was busy passing legislation to strengthen the armed forces. The Republicans nominated Charles Evans Hughes, associate justice of the Supreme Court, on an evasive platform. There was no doubt whom the Democrats would name. Wilson received the nomination on June 15, but the Democrats cheered so wildly for peace that the Democratic campaign slogan was changed from "Preparedness" to "He Kept Us Out of War." Wilson took up the peace theme at the same time that he set out to win a large number of former Progressives. He had begun this campaign earlier by obtaining passage of a bill to establish Federal Farm Loan banks to provide long-term credit to farmers. During the summer and autumn Wilson obtained adoption of other legislation that brought the progressive movement to its first culmination: a federal child labor bill; a Federal Tariff Commission; the eight-hour day for railroad workers; heavy new income taxes on the rich; and the first estate tax in American history. By making progressivism and peace the twin issues of the campaign, Wilson won enough Progressives to transform a Democratic minority

into a majority, although the change of some 1,500 votes in California would have given Hughes a majority in the Electoral College.

Wilson could now turn to the project nearest his heart; mediation of the European war. After many discouragements he asked the belligerents on Dec. 18, 1916, to state the terms upon which they would be willing to stop fighting. Through Colonel House he also began secret negotiations with the British and German governments. The British were apparently ready for serious discussions, but the Germans did not trust Wilson and decided to make one last gamble in a bid for victory with their greatly augmented submarine fleet. Their answer came on Jan. 31, 1917, in the form of a proclamation of unlimited submarine warfare against all maritime commerce, neutral as well as belligerent. Wilson broke diplomatic relations with Germany on February 3, even while he continued to hope for peace. But a series of incidents drove him to armed neutrality and then, reluctantly, to a decision for war. On April 2 he asked for a declaration of war so that America could help to preserve civilization and make the world safe for democracy. Congress adopted the war resolution on April 6, 1917.

**War Leader, 1917-1918.**—Never before had so many urgencies beset a harried president as during the period of American participation in World War I. There were vast new problems of military and industrial mobilization. It took strong pressure from the White House to obtain the Selective Service Act in May 1917. When industrial mobilization lagged, Wilson took control of the railroads in December and established an economic dictatorship under Bernard M. Baruch of the War Industries Board. Wilson was also commander in chief of the largest armed forces in American history; this fact necessitated frequent consultations with military leaders, particularly General Pershing, commander of the American Expeditionary Force in France. There were baffling new diplomatic problems, occa-



THE GRANGER COLLECTION

Wilson (right) meets with the other leaders of the Big Four in Paris before the opening of the Peace Conference.

sioned, for example, by the Bolshevik triumph in Russia and the disintegration of the Austro-Hungarian Empire.

Wilson made his greatest contribution in formulating war aims that for the first time gave some meaning to the conflict. As early as Jan. 22, 1917, he had called for a peace of reconciliation and establishment of a postwar league of nations. He reiterated this plea in his Fourteen Points Address of Jan. 8, 1918. Abandoning the hope for a peace without victory after the Germans imposed a severe peace on Russia in March 1918, Wilson continued to voice the aspirations of liberals throughout the world for a peace based on democracy and self-determination, without annexations and indemnities.

The Germans naturally turned to the American president for armistice discussions when the fortunes of war turned sharply against them in the autumn of 1918. In brilliant negotiations Wilson persuaded the Germans to accept terms that meant virtual surrender, but with the promise that the settlement would be based upon the Fourteen Points and other Wilsonian pronouncements. After some haggling the Allies also agreed, and the Armistice was signed on Nov. 11, 1918.

**The Peace Conference, Treaty Fight, and Retirement, 1919-1924.**—On Dec. 4, 1918, Wilson and a large body of advisers sailed from New York aboard the *George Washington* to take part in the peace conference that would soon assemble in Paris. The president's standing had been weakened only a month before by the election of a Republican Congress after Wilson had asked for a vote of confidence. Wilson had ignored the Senate and leaders of the Republican Party in choosing peace commissioners. But in Europe he was hailed as the savior of mankind and the hope of the future.

The Peace Conference opened at Paris on Jan. 18, 1919, and continued until the Versailles Treaty with Germany was signed on June 28. There were numerous commissions, but all major decisions fell to the so-called Big Four: Wilson, Prime Minister David Lloyd George of Great Britain, Premier Georges Clemenceau of France, and Prime Minister Vittorio Orlando of Italy. Wilson was easily the most commanding figure—he best informed, the man most deeply committed to principles, and the one who, as we can now see, could judge immediate plans by long-range standards. Conflict was inevitable because Wilson meant to vindicate the Fourteen Points, while others were willing to honor them only when such virtue brought immediate reward.

The outcome of this encounter between Wilsonian idealism and European so-called realism was a compromise treaty that both vindicated and violated the Fourteen Points. It tripped Germany of her colonies and saddled her with a huge liability for reparations; it reduced the German Army to impotence; worst of all, it was a *diktat* imposed on the conquered enemy, not the negotiated settlement that the armistice agreement had implied. And yet Wilson did not labor altogether in vain. He prevented dismemberment of Germany in the West; helped to establish a new Poland; won acceptance of the principle that colonies should be administered in trust and a pledge of future general disarmament; and, most important, forced the creation of the League of Nations, with responsibility for executing the treaty and preventing future wars. He was certain that American leadership in the League and the passing of time would rectify the injustices of the settlement.

There were signs that even harder labors lay ahead by the time that Wilson presented

the treaty to the Senate on July 10, 1919. Opposition to American membership in the League, and particularly to the blanket commitment to collective security contained in Article 10 of the League constitution, had been manifest as early as March. By July 1919 isolationist Republicans, led by Senator Henry Cabot Lodge, chairman of the Foreign Relations Committee, were demanding explicit disavowal of this commitment. Unable to obtain speedy action by the Senate because of Lodge's delaying tactics, Wilson set out upon a tour of the West to generate public demand for ratification. He traveled 8,000 miles and delivered 40 addresses, the main burden of which was that future peace and American security depended upon American leadership in the new world community. The physical strain was too great for Wilson's frail body. He nearly collapsed following a speech at Pueblo, Colo., on September 25. Returning to Washington, he suffered a severe stroke and paralysis of the left side on October 2. He was thus either gravely ill or severely incapacitated at the very time that the country needed his leadership most.

The Senate voted on ratification of the Versailles Treaty on Nov. 19, 1919, and again on March 19, 1920. On both occasions Lodge, an implacable foe of both Wilson and the treaty, insisted upon reservations that would have gravely impaired American responsibility to the League. On both occasions Wilson insisted that Democrats vote for rejection rather than accept what he said was nullification of the treaty. If the Republicans would not yield, he said in a public letter on Jan. 8, 1920, then the people could decide the issue in "the great and solemn referendum," the election of 1920. On both votes in the Senate the treaty failed because neither side would budge, although considerably more than the necessary two thirds favored ratification in some form.

The dénouement came quickly and, for Wilson, tragically. The Republicans won in a landslide on Nov. 2, 1920, and the new president, Warren G. Harding of Ohio, lost no time in concluding a separate peace with Germany and making it plain that the United States would never enter the League. Late in 1920 Wilson was awarded the Nobel Peace Prize for 1919. He retired with his second wife, Edith Bolling Galt, whom he had married in 1915, to a home on S Street in Washington, where he lived in virtual seclusion as life slowly ebbed. He was interred in the Bethlehem Chapel of the Washington Cathedral.

See also DEMOCRATIC PARTY; FOURTEEN POINTS; LEAGUE OF NATIONS; UNITED STATES—International Relations and Diplomacy; *The Age of Industrial Growth, 1877–1919*; WORLD WAR I—Diplomatic History of the War.

ARTHUR S. LINK,  
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**WILSON**, city, North Carolina, seat of Wilson County, 40 miles east of Raleigh, at an altitude of 140 feet. The city is on federal highways and has a municipal airport. Primarily an agricultural center, Wilson has a large bright-leaf tobacco market with 19 auction warehouses with 2 million square feet of floor space. A meat-packing plant is situated here, as are a cotton oil mill, a plant for the manufacture of animal feed formulas, and firms making textiles, concrete products, truck and bus bodies, wagons, electronic equipment, agricultural implements, and lumber and wood products. Atlantic Christian College, a four-year liberal arts, coeducational institution, was established here in 1902. The Eastern North Carolina Tuberculosis Sanatorium is also located here. There are parks and a municipal stadium accommodating 3,500 persons. The North Carolina Amateur Golf Tournament is held here annually in June.

Settled in 1847, the city was incorporated in 1849 and was named for the Hon. Louis D. Wilson, an early state senator and Mexican War volunteer. Wilson has a manager-council form of government. Population: 36,930.

NANCY GRAY

**WILSON, Mount**, a peak, 5,710 feet above sea level, in the San Gabriel Mountains of Los Angeles County, Calif., just northeast of Pasadena. It is well known for its scenic views and for the Mount Wilson Observatory, established in 1904, which is operated jointly by the Carnegie Foundation and the California Institute of Technology and has a 100-inch telescope.

See also OBSERVATORY—Mount Wilson and Palomar Observatories.

**WILSON CLOUD CHAMBER**, a device invented by Charles Thomson Rees Wilson (q.v.) in 1912 for detecting the presence of electrically charged (ionized) particles such as alpha and beta particles. It consists of a chamber of moisture-laden air or other gas, in which a sudden, forced expansion and cooling of the water vapor produces a supersaturated condition. This causes a condensation of fog droplets upon any gas molecules which have been ionized by the passage of the energetic particles through them. The heavier alpha particles produce dense, straight cloud tracks and the lighter beta particles, through deflection, produce curved and more diffuse tracks.

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Office of the Director  
National Oceanographic Survey

**WILSON COLLEGE**, a college of liberal arts and sciences for women, located at Chambersburg, Pa. Affiliated with the Presbyterian Church, it is a privately controlled, accredited institution offering a four-year course leading to the degree of bachelor of arts. The campus, through which the Conococheague Creek flows, comprises about 70 acres in the suburbs of Chambersburg. It has dormitories, classrooms, administration buildings, a library, chapel, and other educational facilities. The curriculum permits concentration in all the standard liberal arts disciplines, leading to a comprehensive examination in one. There is a special program of Asian studies. The college, essentially residential, was founded in 1869 and named for Sarah Wilson, who gave the first endowment.

**WILSON DAM**, a dam on the Tennessee River in Alabama, part of the Tennessee Valley Authority system. See **MUSCLE SHOALS**.

**WILT DISEASES**, wílt dī-zéz'éz, diseases of plants resulting from the activities of pathogens that produce a malfunction of the translocation system of the stem. Externally the plants show yellowing of the lower leaves, flagging of upper leaves, and finally wilting of leaves and young stems. The leaves may flag or wilt during the heat of the day and recover overnight for several days before permanent wilting occurs. Stems of wilted plants when cut slightly above the soil line show a brownish discoloration of the vascular system. In trees this discoloration may be found in large branches below wilted twigs. This may occur in only one portion of the vascular cylinder and frequently extends up one side of the stem.

The true wilts are caused by fungi or bacteria growing within the xylem. In herbaceous and shrubby plants the organisms commonly occur in the base of the stem and upper root portions. In trees the organisms may grow in branches well above ground, especially in those cases in which the pathogen is introduced into the tree by insects during feeding or egg laying activities. The common wilts are caused by fungi such as the genera *Fusarium*, *Verticillium*, *Ceratocystis*, and by bacteria of the genera *Erwinia* and *Corynebacterium* among others.

Three explanations for the exact cause of wilting have been vigorously supported: (1) plugging resulting from the physical presence of the pathogen, tyloses, or gums formed by the pathogen or the host reacting to the pathogen; (2) toxins produced by the pathogen that cause a loss of turgidity of parenchymatous cells, or cause tyloses and gums which impede water movements; (3) enzymes that cause the formation of tyloses and gums by their effect on the cells and cell walls (pectinases and cellulases), or that cause losses in the semipermeable nature of cell membranes.

Losses from wilt diseases are usually progressive and may be as high as 90 percent. The agents are soil-inhabiting organisms that usually are only slightly reduced by rotations or other cultural practices. Control of the wilts rests on the use of clean seed, rotation, sanitation, and cultural practices that prevent the introduction and build-up of the pathogens. High grade resistance has been found and incorporated into many commercially acceptable varieties of plants. Soil fumigation to destroy the pathogens and control of insect vectors has been profitable in some cases.

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**WILTING**, wílt'ing, in plants, a term applied to the familiar phenomenon of drooping, folding, or rolling of leaves and other succulent parts of many kinds of plants which occurs whenever an internal deficiency of water develops within the plant of sufficient magnitude to result in the loss of turgidity of the cells. In hot arid regions, or in bright warm weather in most temperate climates, daytime wilting of leaves may be a daily occurrence, even during a period when the soil-water content is adequate. Under such conditions it is usual for the leaves to

regain their turgidity during the night hours even if no water is added to the soil. This type of wilting, commonly referred to as temporary wilting, results from a temporary excess of the rate of evaporational water loss (transpiration) from the plant over the rate of absorption of water by the plant. During the night hours the rate of absorption of water exceeds the rate of transpiration, and the leaves gradually regain the water content and turgidity lost during the day.

When the soil-water content becomes so low that the plant can no longer absorb water at an appreciable rate, the plant passes into the state of permanent wilting. Such plants remain in a wilted condition both night and day and recovery from wilting occurs only if the soil-water content increases. In the absence of rainfall or irrigation, the water content of a plant in a state of permanent wilting steadily diminishes as a result of slow but continuous transpirational loss. Diminution in water content and loss of turgidity of cells gradually becomes systemic throughout the plant during permanent wilting. Ultimately, this leads to the death of many species of plants, although some drought-resistant species can endure the state of permanent wilting for months at a time and recover their normal physiological activities when the water again becomes available.

BERNARD S. MEYER,  
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**WILTON**, wílt'ən, town, Connecticut, in Fairfield County, situated on the Norwalk River, about 5 miles north of Norwalk. With an area of 31.3 square miles, it includes Cannondale, South Wilton, and part of Georgetown village. Chiefly residential, and the home of many artists, authors, and musicians, it has manufactures of golf clubs and of wood and metal products; it is in an agricultural area producing dairy products and fruit, also truck-farming and nursery products. Settled in 1701, it was incorporated in 1801. The town has a Congregational church dating to 1790 and is the seat of the Wilton Historical Society. It is governed by selectmen. Population: 15,989.

**WILTON**, town, Maine, in Franklin County, at an altitude of 690 feet, approximately 38 miles northwest of Augusta, on a federal and a state highway. Wilton is primarily a resort and farming community, and is situated in a heavily wooded area at the point where Wilson Stream flows into Wilson Lake. Wilton Academy is located here, as is the Goodspeed Memorial Library. It is the site of a shoe factory, and several other plants, making shoes, wooden and plastic novelties, and canned goods are in the area. Wilson Lake, a short distance west of the business district, is a popular vacation spot, with numerous summer camps in its environs.

Settled in 1789, and alternately known as Harrytown and Tyngstown, it was incorporated in 1803 as Wilton when Abraham Butterfield of Wilton, N.H., who had paid his incorporation expenses, renamed the settlement in honor of his original home. Wilton is governed by a town manager. Population: 4,242.

IDA MELENDY.

**WILTON CARPET**. See **RUGS AND CARPETS**.



**WILTON MANORS**, wil'tən măn'ərz, city, Florida, in Broward County, located on the Atlantic Ocean just north of Fort Lauderdale, from which it is separated by Middle River. A residential community, Wilton Manor contains various recreational facilities, including Mickel Field, a baseball stadium. The area was settled in the early years of the 20th century by W. J. Willingham and was named by him in honor of his wife, whose maiden name was Wilton. Originally an orange grove, the site was developed during the Florida real-estate boom in 1926. It became a village in 1947 and was incorporated in 1953. Government is by mayor and council. Pop. 11,804.

**WILTSHIRE**, wilt'shīr, or **WILTS**, wilts, county, England, covering 1,345 square miles and bounded by the counties of Gloucester, Berkshire, Hampshire, Dorset, and Somerset. It is crossed by a broad belt of chalk upland, northwest and southeast of which are fertile and mainly well-watered agricultural lands. The principal rivers are the Salisbury Avon (East Avon), flowing generally southward; the Bristol Avon (or Lower Avon), flowing northwestward; and the Kennet, flowing eastward.

Settlements are mostly confined to the lower ground, but in prehistoric times the uplands were the most densely populated part of Britain. The whole area is marked by Neolithic remains, including Stonehenge and Avebury (qq.v.). Swindon is the biggest industrial center. A large dairying area in the west is served by Devizes, Melksham, Chippenham, Calne, and Trowbridge, the county town. Wilton is famed for its carpets, and building stone is quarried at Box. The most notable buildings are the cathedral at Salisbury, or New Sarum, and the abbey at Malmesbury. There is a well-known public school for boys at Marlborough. Pop. (1961) 422,753.

H. GORDON STOKES.

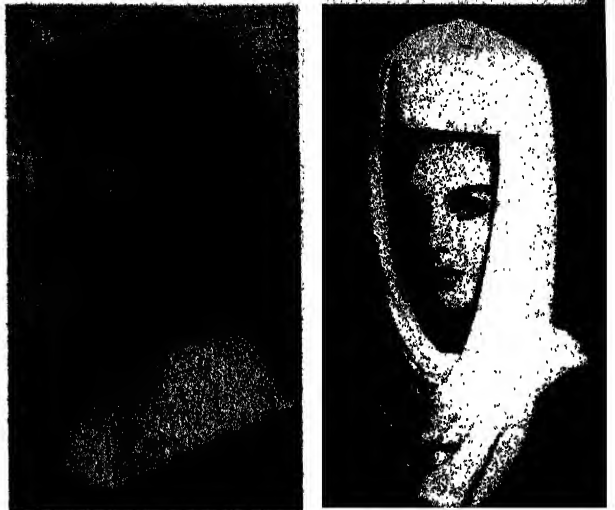
**WIMBLEDON**, wim'bəl-dən, municipal borough, England, residential suburb of southwest London, situated in Surrey. It is widely known for the championship tennis tournaments held annually by the All-England Tennis and Croquet Club since 1886. Wimbledon Common, covering about 1,200 acres, is a beautiful expanse with trees and bracken, ponds and lakes, a windmill, and a large earthwork popularly known as Caesar's Camp, although it is of Celtic origin. St. Mary's church retains 13th and 14th century features. Pop. (1961) 56,994.

H. GORDON STOKES.

**WIMBORNE MINSTER** or **WIMBORNE**, wim'bōrn, urban district, England, in eastern Dorset, an important market center in the valley of the Stour River. Its outstanding feature is the minster, or collegiate church. A nunnery founded on the site in the 8th century acquired fame as the burial place of King Æthelred I. Danish raiders destroyed it, and the present building was begun soon after the Norman Conquest. It contains a valuable library of old books chained to the desks and an astronomical clock made in 1325. Pop. (1961) 4,156.

H. GORDON STOKES.

**WIMPLE**, wim'pəl, a woman's garment, usually of linen or silk, covering the top and back of the head, the sides of the face, and the chin and



(Left) Black Star; (right) Bergdorf Goodman

Left: A wimple worn by a German nun. Its design dates back to medieval times. Right: A modern hat and scarf assembly reflecting the influence of the wimple.

neck. During the medieval period, it was often worn with a separate gorget covering the chin and neck and another piece over the forehead. The material framing the face was usually white, and the wimple was either white or a contrasting color. As more elaborate headdresses became fashionable during the early Renaissance, the wimple continued to be worn by widows, older women, and nuns; it is still a customary head-dress for nuns. The wimple has enjoyed periodic revivals in fashion.

**WINANS**, wī'nənz, **Ross**, American inventor and mechanic: b. Sussex County, N.J., Oct. 17, 1796; d. Baltimore, Md., April 11, 1877. In 1828, while in Baltimore for the purpose of selling horses to the Baltimore & Ohio Railroad, he became interested in the new system of transportation. The following year he was sent by the Baltimore & Ohio Railroad to study railroads in England, and on his return assisted Peter Cooper in building the "Tom Thumb." In 1831 he built the "Columbus," the first railroad car mounted on two four-wheeled trucks, and patented the first friction wheel and the first wheels and axles with outside journals for railroad cars.

In 1834, Winans formed a partnership with George Gillingham, and they began the manufacture of locomotives for the Baltimore & Ohio in 1835. Invited to Russia in 1843 to build rolling stock, he sent two of his sons in his stead and established his own locomotive shop. The powerful "camelback" was built in great numbers until Winans closed the shop in 1860. He then experimented with a cigar-shaped steamboat, which, though prophetic, was unsuccessful. During the Civil War, he was favorable to the Confederate cause and was a member of the Maryland legislature in 1861. On returning to Baltimore he was arrested for high treason but soon released.

**THOMAS DE KAY WINANS**: b. Vernon, N.J., Dec. 8, 1820; d. Newport, R.I., June 10, 1878. A son of Ross Winans, he was sent by his father in

1843 to negotiate with the Russian government for the equipment for a railroad to be built between St. Petersburg and Moscow. With Joseph W. Harrison, he secured the contract, fulfilling it within four years rather than the stipulated five. He returned to the United States in 1851, worked with his father on the cigar-shaped steamboat, and invented a tubular feeding device for young trout and other devices.

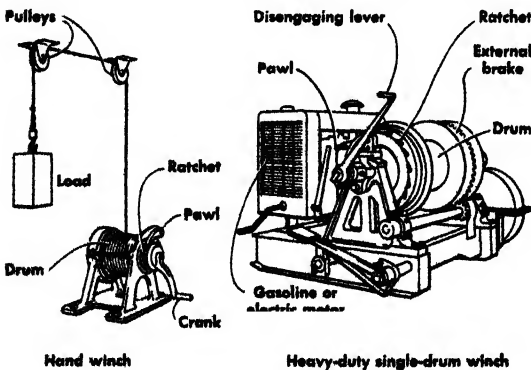
LAWRENCE W. SAGLE,  
Director, Baltimore & Ohio Museum.

**WINANT**, wī'nənt, **John Gilbert**, American diplomat: b. New York, N.Y., Feb. 23, 1889; d. Concord, N.H., Nov. 3, 1947. He was educated at St. Paul's School, Concord, N.H., where he later taught, and at Princeton University, before becoming an aviator during World War I. After serving three times in the state legislature, he was governor of New Hampshire in 1925-1927 and 1931-1935. A liberal Republican, he reorganized state agencies, initiated social reforms, and welcomed the New Deal welfare programs. President Franklin Delano Roosevelt appointed him to mediate the textile strike in 1934. Designated assistant director of the International Labour Organization (ILO) in Geneva in 1935, he was shortly recalled to become the first chairman of the Social Security Board. In 1937, he returned to Geneva to the position of assistant director of the ILO, becoming director in 1939.

As ambassador to Great Britain, 1941-1946, his courage and devotion strengthened the Allied cause. Later, as United States representative on the European Advisory Commission, Winant was frustrated by insufficient directives. After the war he served as United States representative on the United Nations Economic and Social Council and as honorary chairman of the National Conference of Christians and Jews. His book, *Letter from Grosvenor Square*, was published in 1947 a few days after he committed suicide.

BERNARD BELLUSH.

**WINCH**, wīnch, a somewhat elaborate form of windlass (q.v.). The term originally meant the crank, projecting handle, or lever by which a revolving machine was turned, but is now gen-



Hand-operated and power-driven winches.

erally applied to a powerful machine having one or more drums on which a rope is wound for lifting or hauling a heavy object. It may be hand operated or power driven. Winches are used on derricks for raising objects into position,

on tractors for pulling heavy artillery and up-rooting trees, on shipboard for hoisting anchors, or in stationary installations. The winding drum of those on derricks is equipped with a brake that is applied when the load is lowered. Hand winches mounted on skids and used independently are called crabs.

FRANK DORR.

**WINCHELL**, wīn'chəl, **Alexander**, American geologist and educator: b. Northeast, Dutchess County, N.Y., Dec. 31, 1824; d. Ann Arbor, Mich., Feb. 19, 1891. A graduate of Wesleyan University, Middletown, Conn., in 1847, he was professor at the University of Michigan from 1853 to 1873, working on the state geological survey in 1859-1861 and 1869-1871. He was chancellor of Syracuse University 1873-1874 and professor at Vanderbilt University 1875-1878 before returning to Michigan in 1879 as professor of geology and paleontology. He was a founder of the Geological Society of America. Best known as a popularizer of scientific subjects, especially evolution, Winchell lectured frequently and wrote many articles and books, including *Sketches of Creation* (1870), *The Doctrine of Evolution* (1874), *World Life* (1883), and *Geological Studies* (1886).

**WINCHELL**, **Newton Horace**, American geologist and archaeologist: b. Northeast, Dutchess County, N.Y., Dec. 17, 1839; d. Minneapolis, Minn., May 2, 1914. A brother of Alexander Winchell, he graduated from the University of Michigan in 1866 and worked on the state geological survey of Michigan in 1869-1870 and of Ohio in 1870-1872. Appointed state geologist of Minnesota in 1872 and professor at the University of Minnesota in 1874, he retained both posts until 1900. He was a founder of the Geological Society of America and *American Geologist*, a periodical which he edited with his son, Horace Vaughn Winchell (1865-1923), an economic geologist and coauthor with his father of *The Iron Ores of Minnesota* (1891). With another son, Alexander Newton Winchell (1874-1958), mineralogist and petrologist, he wrote *Elements of Optical Mineralogy* (1909). His other works include *Catalogue of the Plants of the State of Michigan* (1861) and *The Aborigines of Minnesota* (1911).

**WINCHELL**, **Walter**, American journalist: b. New York City, April 7, 1897; d. Los Angeles, Calif., Feb. 20, 1972. He quit school at 13 and, except for service with the naval reserve in World War I, was a vaudeville performer until he joined the staff of a theater-circuit organ in 1922. In 1924 he went to the New York *Evening Graphic*, where he originated the gossip column with immediate success. He joined the New York *Daily Mirror* in 1929, and his column became syndicated, attracting an estimated one third to one half of the readers of the newspapers in which it appeared. In 1932 he started his equally successful radio broadcasts and later appeared in films and on television.

Although accused of being more often wrong than right in his reporting, Winchell acquired undisputed influence as an arbiter of celebrity in politics and crime as well as entertainment. His compressed ungrammatical coinages were widely imitated, and his exploitation of public interest in the private affairs of the famous had

an enormous impact upon contemporary journalism.

**WINCHENDON**, wīn'chən-dən, town, Massachusetts, in Worcester County, on Millers River, 36 miles northwest of Worcester and 5 miles south of the New Hampshire border. Dairying and poultry raising are among the area's principal agricultural activities. A wood-working industry, taking advantage of the natural timber resources, began in the late 1820's and eventually specialized in the manufacture of toys. Over the course of the years, Winchendon became known popularly as Toy Town.

Settled in 1753, it was known as Ipswich Canada until it was renamed in honor of Winchendon, England, in 1764, when it was incorporated. The town comprises Winchendon, Winchendon Springs, and Waterville. The municipal government is conducted by town meeting. Pop. 8,805.

**WINCHESTER**, wīn'chēs-tər, **Oliver Fisher**, American industrialist: b. Boston, Mass., Nov. 30, 1810; d. New Haven, Conn., Dec. 11, 1880. He was a carpenter's apprentice, a clerk, and a construction worker before establishing a men's clothing store in Baltimore, Md., and later an extremely successful shirt-manufacturing company, one of the first in the United States, at New Haven, Conn. He became principal stockholder in the Volcanic Repeating Arms Company and reorganized it in 1857 as the New Haven Arms Company, producing the Henry rifle. After acquiring other patents, he again reorganized the company in 1866 as the Winchester Repeating Arms Company, which produced the famous Winchester rifle. (See *SMALL ARMS—The 19th Century*.) Winchester was elected to serve as lieutenant governor of Connecticut in 1866. He was widely known for his many philanthropies and in particular for his benefactions to Yale University.

**WINCHESTER**, town, Connecticut, in Litchfield County, 9 miles north of Torrington and 27 miles northwest of Hartford. The topography of the area (36 square miles) is rugged, with numerous hills and valleys. The major drainage system is provided by the Still and Mad rivers.

The town is primarily residential with the exception of its main population center, the city of Winsted. Principal industries are the manufacture of electrical goods, appliances, wire, clocks, machine tools, hosiery, pins, silk thread, and fish line. Winchester's industrial history began early, fostered by the abundance of water power at Winsted, the confluence of the Still and Mad rivers. Recreational facilities include the Taylor Brook Camp Ground, a 172-acre state park adjacent to Highland Lake.

Deriving its name from Winchester, England, the town was first settled in 1750 and incorporated in 1771. Government is of the selectmen-town meeting form. Pop. 11,524.

ROBERT C. SALE.

**WINCHESTER**, municipal borough, England, county town of Hampshire, located on the west side of the Itchen River, 11 miles north of Southampton. For all its modern bustle as an important administrative and commercial center, Winchester is an ancient borough and was long the capital of the kingdom. A Celtic settlement,

Caer Gwent, existed on St. Catherine's Hill on the east side of the Itchen before the Romans built a walled town (Venta Belgarum) on the present site in the 2d century A.D. Under the Saxons, Winchester (called Wintecæster) became the capital of Wessex in the 6th century, and in the 7th century, when Christianity was introduced, a cathedral was built and an episcopal see established. Winchester was chosen as the seat of government under Alfred the Great (r. 871-900/901) and the Danish kings (r. 1016-1042).

After the Norman Conquest, Winchester prospered because William the Conqueror (r. 1066-1087) made it co-capital with London and a thriving woolen trade developed, lasting through the medieval period. The Normans rebuilt the town walls and erected a castle, of which little remains except the Great Hall (altered by Henry III in 1235), where English parliaments met for nearly 400 years. In it is a painted table, 17 feet in diameter, from the 13th century or earlier, which legend once identified as the Round Table of King Arthur, as Winchester was identified with legendary Camelot. Winchester Cathedral (q.v.) was begun in 1079 and largely rebuilt by William of Wykeham (1324-1404), who also founded Winchester College (q.v.). The Hospital of St. Cross is a picturesque almshouse, founded in 1136; the endowment also provided for a slice of bread and a horn of ale for wayfarers, a practice still maintained. The 13th century West Gate of the city houses a small museum. There are remains of the 12th century Wolvesey Castle, the original bishops' residence, near Wolvesey Palace, now destroyed except for the wing that was designed by Sir Christopher Wren (1632-1723) which is the present bishop's residence. Pop. (1961) 28,643.

H. GORDON STOKES,  
Author of "English Place-Names."

**WINCHESTER**, city, Indiana, seat of Randolph County, on West Fork of White River. It is 23 miles east of Muncie, where Lake Central Airlines operate from Johnson Field. Winchester is an important livestock and grain shipping center in a rich agricultural district. Glass and the molds used in the glass industry are its most important manufactured products.

The first town in Randolph County, Winchester was settled in 1814 and became county seat in 1818. Nearby are the Fudge Mounds, covering 31 acres, which have yielded Indian relics of historical interest. Government is by mayor and council. Pop. 5,095.

ELIZABETH ABEL MASON.

**WINCHESTER**, city, Kentucky, seat of Clark County, 18 miles southeast of Lexington and 9 miles north of the Kentucky River, on federal and state highways. It is primarily a residential community, situated in a prosperous agricultural region of the "bluegrass" country, noted for its cattle, sheep, horse, and turkey farms. It is equally noted as a Burley tobacco center. Clothing, lumber, brick, beverages, tubing, bed-springs, flashbulbs, and projection lamps are manufactured in the city. Southeastern Christian College, a junior college, is located in Winchester, which is also the headquarters of Cumberland National Forest. There is a daily newspaper, a radio station, and a public library.

America's oldest trail, the Warrior's Path,



passes through Winchester, which was incorporated in 1793 and named by its founder, John Baker, after Winchester, Va. Henry Clay made his first and last speeches in the Clark County Court House. Government is by city commission. Population: 15,799.

**WINCHESTER**, town, Massachusetts, in Middlesex County, on the Aberjona River, about 11 miles northwest of Boston, on a state highway. It is primarily a residential suburb of Boston. Leather and glue were manufactured here for many years from the latter part of the 19th century; watch hands, gelatin, and food products are now manufactured.

The first permanent settlement was established in 1640, and the town was incorporated in 1850. Originally a part of Charlestown, it later became a part of Woburn and was called South Woburn. Its present name was given in honor of Col. William P. Winchester, a merchant and local benefactor. Among the well-known residents of Winchester were Samuel McCall and John A. Volpe, governors of Massachusetts; Edward Everett, the 19th century orator; and Edwin Ginn, publisher and founder of the World Peace Foundation. The public library houses a collection of Civil War books. Government is by limited town meeting. Population: 20,267.

WHITNEY SMITH, JR.

**WINCHESTER**, city, Virginia, seat of Frederick County but an independent city, located in the Shenandoah Valley, 72 miles west of Washington, D.C. The municipal airport is two miles south of the city. Known as the Apple Capital, Winchester is famous for its apple products and its annual Apple Blossom Festival. Its manufactures include rubber and plastic products, furniture, knit goods, spray chemicals, conveyor belts, brake components, frozen foods, barrels, brick, tile, and lumber. Shenandoah College and Conservatory of Music is located in the city. The public school system and Handley Library are endowed.

The oldest city in Virginia west of the Blue Ridge, Winchester was settled in 1732, incorporated in 1874, and named after Winchester, England. While on a surveying expedition for Lord Fairfax, George Washington maintained an office there. It is rich in historical interest (see **WINCHESTER, MILITARY OPERATIONS AT**) and attracts thousands of tourists each year. Willa Cather and Richard E. Byrd were born in Winchester. Government is by city manager, mayor, and council. Population: 21,947.

MRS. RUSSELL O. LAFOLLETTE.

**WINCHESTER, Military Operations at.** Winchester, Va., was strategically important to both sides during the American Civil War. To the Confederacy, it afforded a good base for defending the entrance to the Shenandoah Valley, a rich source of supplies throughout the war, and it was a key point on an invasion route to northern territory. From the Union viewpoint, it was a good base for drives up the valley; further, in Union hands it afforded protection to the important Baltimore & Ohio Railroad.

**1861-1862.**—Winchester changed hands many times during the war. In June 1861, it was used as a base for Confederate Gen. Joseph E. Johnston's troops, guarding against invasion, before they moved eastward for the First Battle of Bull

Run (July 18-21). It was garrisoned by Confederate troops, commanded by Gen. Thomas J. (Stonewall) Jackson, until March 11, 1862, when he pulled back from advancing Union forces led by Gen. Nathaniel P. Banks. Ten days later, Banks decided to move most of his troops toward Washington. Instructed to prevent the move, Jackson attacked on March 23 at Kernstown, three miles south of Winchester. (See **KERNSTOWN, BATTLE OF**.) The Confederates suffered defeat, but all of Banks' troops were recalled to the valley.

With Banks following, Jackson again retreated southward. Suddenly, on May 21, he moved north, outflanked Banks by going eastward and then north through the Luray Valley, overran a small Union detachment at Front Royal, and almost cut off Banks at Middletown. The Union general, retreating northward, elected to stand and fight at Winchester on May 25. Outnumbering them 2 to 1, Jackson's forces pinned down the bulk of the enemy with a frontal attack while enveloping their right. Banks had no choice but to withdraw and flee across the Potomac River. A week later, Jackson moved south to avoid encirclement by Banks, now reinforced. Union forces then held Winchester until the beginning of the Antietam Campaign, when it was abandoned to Gen. Robert E. Lee's troops on Sept. 2, 1862. When Lee moved back from Pennsylvania, he left a small garrison in the town, which was expelled on December 27 by Gen. Robert H. Milroy's troops.

**1863.**—Milroy occupied the area in force until Lee again moved north en route to Gettysburg in June 1863. With 8,000 men, Milroy defended Winchester on June 12-15 against Gen. Richard S. Ewell's corps. In a costly battle—Milroy had been ordered to retreat to Harper's Ferry earlier—the Union force lost all its artillery and one third of its strength as Ewell encircled and almost bagged the entire lot. Lee retreated through Winchester in mid-July, after which the Union kept a small detachment there.

**1864-1865.**—In July 1864, Gen. Jubal A. Early led a strong force down the Shenandoah Valley, seized the town, threatened Washington, and raided Pennsylvania. Gen. Ulysses S. Grant, tired of the valley diversions, sent Gen. Philip H. Sheridan there to settle the issue with finality. He inflicted three defeats on Early in September-October 1864 and drove him from the valley, never to return. The first of these battles took place at Winchester on September 19. Early, outnumbered 2 to 1, at first appeared to be winning, but Sheridan overlapped his flanks and soon forced a withdrawal which almost became a rout. Winchester remained in Union hands until the end of the war.

See also **SHENANDOAH VALLEY—The Civil War**.

THOMAS E. GRIESS,  
*Lieutenant Colonel, United States Army; formerly Associate Professor, History of Military Art, United States Military Academy.*

**WINCHESTER CATHEDRAL**, Winchester, England, the longest Gothic cathedral in Europe. It has a length of about 560 feet. Founded in 1079 by Bishop Walkelin, it retains its original Norman form in its north and south transepts. Important alterations were made in the late 12th century by Bishop Godfrey de Lucy, who enlarged the famous shrine of St. Swithin. The west front

was rebuilt in the middle of the 14th century by Bishop William Edington. The first major reconstruction, however, was the work of William of Wykeham, who, at the close of the 14th century, built the new Perpendicular nave, celebrated for its noble columns, its soaring arches, and its intricately sculptured vaulting. At the beginning of the 16th century, Bishop Richard Foxe restored the presbytery, embellishing it with unusual decorations, notably the carved and painted bosses on its roof. Damaged during the Reformation, the cathedral was restored during the reign of Charles I, when its tower was converted to a belfry and the stone screen, designed by Inigo Jones, was built between the nave and the choir. William of Wykeham, Isaac Walton, and Jane Austen are buried in the cathedral.

**WINCHESTER COLLEGE** or **ST. MARY'S COLLEGE**, a boys' preparatory school at Winchester, England, the oldest of the English great public schools. Founded in 1382 by William of Wykeham, it was opened in 1393. The architecture of the original buildings, which are still in use, is exceptionally fine. From its establishment, the school has had scholarships to New College, Oxford, also founded by William of Wykeham. The school has educated a great many prominent men, including Sir Thomas Browne, Thomas Otway, William Collins, and Sir Stafford Cripps. Seventy scholars are chosen by competitive examination and are educated at reduced fees or free. A wide range of subjects is taught, and academic standards are high. In their last years, the boys study in one of three curricula—classics, modern subjects, or mathematics and science. Enrollment averages about 520 pupils.

**WINCKELMANN**, vīng'kəl-mān, **Johann Joachim** (1717–1768), German archaeologist and art historian. The son of a cobbler, he was born in Stendal, Prussia, on Dec. 9, 1717. He studied theology at Halle and medicine at Jena and was a tutor of languages for several families at Seehausen. Having displayed extraordinary talent in the study of Greek and Latin, he was appointed (1748) secretary of the library of Count Heinrich von Bülow at Nöthnitz, near Dresden, where he expanded his considerable knowledge of classical civilization and became acquainted with the artist Adam Friedrich Oeser. After joining the Roman Catholic Church in 1754, Winckelmann was named librarian to Domenico Cardinal Passionei and went to Rome the next year. In Rome he met the painter Anton Raphael Mengs and Alessandro Cardinal Albani, a collector of antiquities, who became his patron in 1758. From 1763 he was prefect of antiquities and scribe of the Vatican.

Although he never realized his ambition to travel to Greece and Sicily, Winckelmann was able to devote his attention to the archaeological excavations then in progress in Italy. In 1758 and 1762 he visited Naples to observe the excavations being conducted in that vicinity. As a result of these visits, he published *Sendschreiben von den Herculanischen Entdeckungen* (1762; *Letter About the Herculean Discoveries*) and *Nachrichten von den neuesten Herculanischen Entdeckungen* (1764; *Report About the Latest Herculean Discoveries*), which acquainted the world of scholarship with the excavations at Pompeii and Herculaneum. Winckelmann's major work was his *Geschichte der Kunst des*



ALLAN CASH, LONDON

Winchester Cathedral, in England, the longest Gothic cathedral in Europe, was begun in the 11th century.

*Alterthums* (1764; Eng. tr. *The History of Ancient Art*, 1849–73), which influenced, among others, Gotthold Ephraim Lessing, who based much of his *Laokoön* on it. Returning to Italy after a visit in Germany, Winckelmann was murdered in Trieste on June 8, 1768, while being robbed of some medals that had been given to him by the Empress Maria Theresa.

Winckelmann was the founder of modern scientific archaeology. He developed the first techniques for determining the relative antiquity of sculptures unearthed in excavations. His approach was philosophic: he attempted to account for the superiority of Greek art by the political institutions that gave rise to it. More than any of his predecessors, he devoted his attention to the works of art themselves rather than to the lives of the artists. While he tended to concentrate on types of art, somewhat to the detriment of individuality, he established some of the epochs in the history of ancient art that are recognized, with modifications, today. His works, written in a clear and precise style, were instrumental in the rise of the neoclassical movement in art during the late 18th century. Editions of his collected works appeared in 1808–1834, in 1847, and in 1934.

MICHAEL WYSCHOGROD  
Bernard M. Baruch College

WIND. See WINDS.




## IN CUSTOMARY U.S. UNITS

Wind Speed (mph)	Thermometer Reading in Fahrenheit Degrees							
	50	40	30	20	10	0	-10	-20
	Equivalent Calm-air Temperature							
Calm	50	40	30	20	10	0	-10	-20
5	48	37	27	16	6	-5	-15	-25
10	40	28	16	4	-9	-24	-33	-43
15	36	22	9	-5	-18	-33	-43	-53
20	32	18	4	-10	-23	-38	-48	-58
25	30	16	0	-15	-28	-43	-53	-63
30	28	13	-2	-18	-33	-48	-58	-68
35	27	11	-4	-20	-35	-50	-60	-70
40	26	10	-6	-21	-37	-52	-62	-72

## IN METRIC (S.I.) UNITS

Wind Speed (kph)	Thermometer Reading in Degrees Celsius							
	10	4.4	-1.1	-6.7	-12.2	-17.8	-23	-29
	Equivalent Calm-air Temperature							
0	10	4.4	-1.1	-6.7	-12	-18	-23	-29
8	8.9	2.8	-2.8	-8.9	-14	-21	-26	-32
16	4.4	-2.2	-8.9	-16	-23	-31	-36	-43
24	2.2	-5.6	-13	-20	-28	-36	-43	-50
32	0	-7.8	-16	-23	-32	-39	-47	-55
40	-1.1	-8.9	-18	-26	-34	-42	-51	-59
48	-2.2	-11	-19	-28	-36	-44	-53	-61
56	-2.8	-12	-20	-29	-37	-45	-54	-62
64	-3.3	-12	-21	-29	-38	-47	-56	-64

Adapted from a table published in *Patent Cure*.

	Normally little danger for properly dressed person in good health
	Considerable danger, exposed flesh can freeze quickly
	Great danger

**WIND CAVE NATIONAL PARK** is in the Black Hills of southwest South Dakota about 10 miles (16 km) north of Hot Springs. The park is named for the wind that blows in or out of the mouth of Wind Cave, which is the main attraction. Established in 1903, the park has an area of about 28,000 acres (11,200 hectares), mainly rolling, light-colored prairies and wooded hills used as a game preserve.

Wind Cave, perhaps once the sacred Cave of the Winds of the Sioux Indians, was officially discovered by cowboy Tom Bingham in 1881. It was formed by the action of groundwater dissolving limestone. About 7 miles (11 km) of the cave are known, including chambers 30 to 100 feet (9-30 meters) high. The cave is famous for its intricate boxwork—delicate veins of calcite deposited in fractures of limestone—and for its frostwork—tiny white crystals that hang from the ceilings and on the walls. A trip in the cave

covers about 1.25 miles (2 km) and takes about 1.5 hours. The route is lighted electrically, and a tour guide is in charge of each trip. Tours are not available during the winter.

Other attractions within the park include prairie-dog towns and large herds of bison. Other animals include deer, elk, pronghorns, badgers, coyotes, and raccoons.

Activities include camping, guided tours, hiking, nature walks, picnicking, and scenic drives. The park is operated by the National Park Service.

**WIND CHILL FACTOR**, a measure of the cooling effect of wind. In cold weather a person loses more heat when the wind is blowing than when it is calm. For example, when the temperature is 10° F (-12° C), a 20-mph (32-kmph) wind will make a person's body lose as much heat as it would in calm air at -25° F (-32° C). This apparent temperature drop is commonly referred to as the wind chill factor. The wind chill factor is greater for high winds than it is for moderate winds, and is greater at low temperatures than it is at moderate temperatures.

The accompanying table shows wind chill factors for winds from 5 to 40 mph (8-64 kmph) at temperatures from 50° F (10° C) to -20° F (-29° C). Winds higher than 40 mph do not greatly increase wind chill factors.

**WIND EROSION.** See *EROSION—Wind*.

**WIND IN THE WILLOWS**, an animal fantasy by the English writer Kenneth Grahame, published in 1908. Both a children's classic and an allegory for adults, *The Wind in the Willows* began as bedtime stories told to Grahame's six-year-old son.

The whimsical story tells of the adventures of four friends—the shy, unsophisticated Mole; the friendly, adventurous Water Rat; the wealthy, careless playboy Toad; and the reserved, philosophical Badger. The animals, denizens of the English countryside where Grahame lived, serve as counterparts of the human world to allegorize Grahame's reflections on life.

Mole wanders out into the sunshine, where he meets Water Rat, who offers to guide Mole on an excursion, warning him against the Wild Wood, the Wide World, and Society. After a series of mishaps befall Toad in these dangerous places, Mole, Water Rat, and Toad, under the tutelage of Badger, settle contentedly in their own environment.

**WIND INSTRUMENTS** comprise one of the three major families of musical instruments, the others being the strings and the percussions. Wind instruments are sounded through the emission of air, either the human breath or a bellows or other mechanical device.

In the first instance, the wind instruments in the modern orchestra are divided into the woodwinds (winds) and the brasses. The woodwinds are the flute, piccolo, oboe, English horn, clarinet, and bassoon. The brasses are the French horn (or, simply, horn), trumpet, trombone, and tuba.

The major wind instrument having air supplied by mechanical means is the organ (pipe organ). Other examples are the bagpipe and the accordion. Certain electronic musical instruments such as the electric organ, approach the sound of wind instruments, although they are not operated by air. See also articles on individual instruments.

**WIND RIVER RANGE**, a section of the Rocky Mountains in west central Wyoming. It extends about 120 miles (190 km) in a northwesterly direction along the border between Sublette and Fremont counties, and forms part of the Continental Divide. There are ten peaks over 13,000 feet (3,960 meters) in elevation, including Fremont Peak (13,730 feet, or 4,185 meters) and Gannett Peak (13,785 feet, or 4,202 meters), the highest point in Wyoming. Wind River flows east of the mountains, and Green River west of them.

The area has a rich history. Washington Irving described the activities of fur trappers of the early 1800's in *The Adventures of Captain Bonneville, U. S. A.* (1837), and John Charles Frémont wrote about his explorations in 1842 with Christopher (Kit) Carson. The Oregon Trail went through South Pass (7,550 feet, or 2,300 meters) in the range, where gold was discovered in 1842.

**WIND, SAND AND STARS** is a book by the French author and aviator Antoine de Saint-Exupéry, first published in 1939. Titled *Terre des hommes* in French, it was translated into English by Lewis Galantière. A series of reminiscences of the author's experiences in the early days of transport airlines, the book begins with his first mail flight from Toulouse, France, to Dakar, Senegal, relates adventures in South America, and returns to Africa with a grueling description of a crash in the desert and the waterless journey toward an almost impossible rescue. Another chapter gives glimpses of Saint-Exupéry's months as a reporter during the Spanish Civil War.

The book is noteworthy for its vignettes of people from many places—vignettes which give breadth and depth to Saint-Exupéry's pictures of strange lands and ways of life: Guillaumet and Mermoz, pioneering the Andes in fragile airplanes; two little girls in Argentina whose pet snakes live under the dinner table; Bark, the slave rescued from bondage, who discovers a new isolation; Bonnafous, the French leader of desert raiders; a Spanish sergeant receiving the news that a fatal mission during the Civil War has been called off.

In a lyric prose which Galantière unfortunately fails to capture, Saint-Exupéry expounds a large thesis. Each adventure, each character in miniature, is linked to the whole narrative not by plot but by theme. The book is a fearless and moving affirmation of the dignity of man, of the worth of the individual, of the mystery of human life. The essence of Saint-Exupéry's philosophy appears in such an episode as his chance landing on a desert plateau, inaccessible except by air. He knows that he is the first human being to walk this sand, and he finds there only a few pieces of meteorite—a rain from the stars. The miracle is that between the sand and the stars a human consciousness understands and reflects.

Wind, sand, and stars are the elements of the desert, but they are elements which give the mind room to grow and the spirit room to be free. In spiritual and intellectual freedom are the positive values of life; death can be relegated to comparative insignificance. Life as an adventure and a challenge, a world to be molded by creative experience—these are for Saint-Exupéry the final good.

DELANCEY FERGUSON  
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**WIND TUNNEL**, a tunnellike passage through which a homogeneous jet of air is blown to determine its effects upon scale models of objects that will be exposed to such forces. The predominant application of the wind tunnel is in the field of aeronautical research and development. The validity of the experiments depends upon the principle that air moving past a stationary model at a known velocity yields the same forces as those that would act upon the model if it were moving at the same velocity through still air.

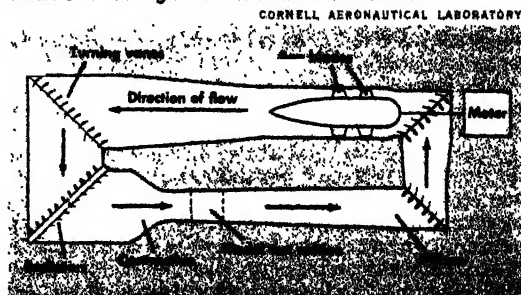
Theoretical and empirical methods for the prediction of flight characteristics are utilized in the preliminary-design stages of aircraft, but it is difficult to estimate the stability, control, and drag characteristics to the degree of accuracy required for final design. When the preliminary design is completed, a scale model of the configuration is constructed, and a test program is run in a wind tunnel to verify the designer's estimates. A study of the experimental data usually results in revisions of the configuration, followed by confirming wind-tunnel tests, until the desired aerodynamic characteristics are realized.

At this stage, extensive wind-tunnel test programs on the final configuration are initiated to establish the complete flight characteristics, control-surface hinge moments, and other related aerodynamic information throughout the speed range of the aircraft. The information is usually obtained by supporting a scale model in the air-stream and measuring the resultant forces and moments with a balance mechanism. Pressures on the various components of the model are frequently measured by gauges connected by tubing to small orifices on the surface of the model.

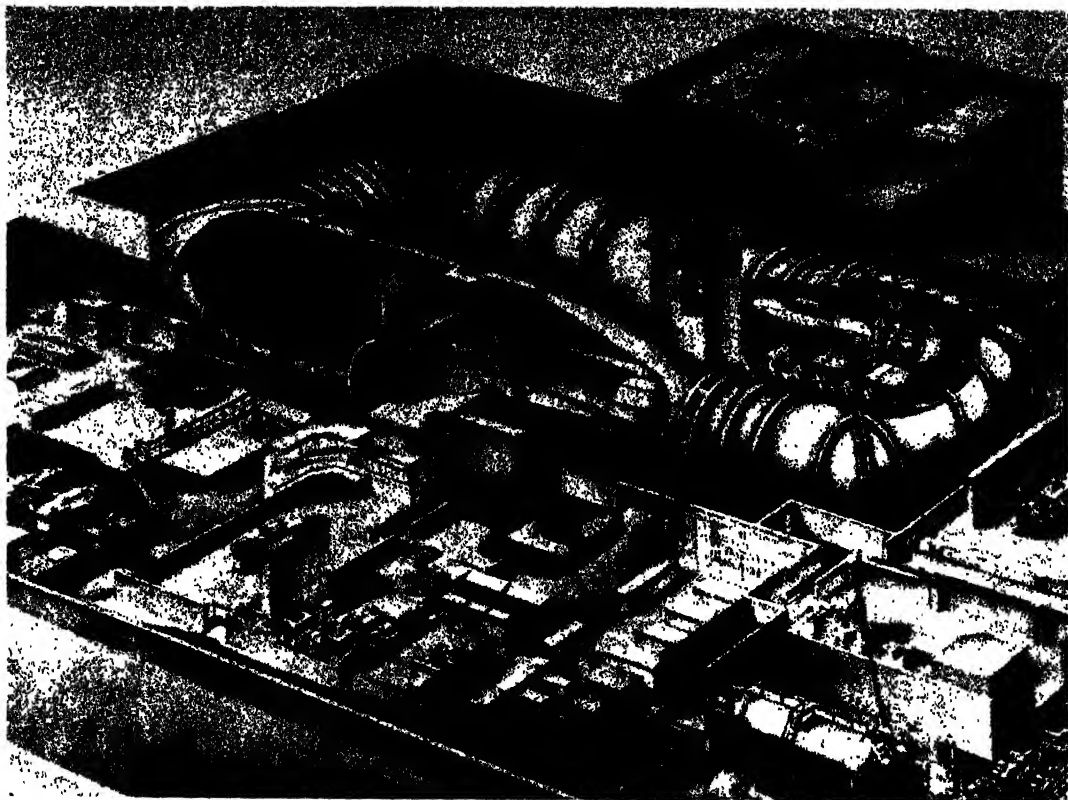
Although they were not the first to employ such a device, the Wright brothers built and used a wind tunnel before they made their first successful flight in 1903. A circular section acted as a shroud for the fan, which sucked air through the box-shaped test section. A 2-bladed, 24-inch-diameter fan, driven by a 2-horsepower gasoline engine, produced a maximum wind velocity of 27 miles (43 km) per hour. Higher-speed aircraft have, of course, necessitated the construction of wind tunnels of much greater size and complexity, some of them developing hundreds of thousands of horsepower, but the original objective of obtaining a homogeneous jet of air traveling at a controlled velocity has not changed.

**Types.** The basic elements of a continuous-flow, closed-circuit tunnel are shown in the accompanying figure. The motor-driven fans propel the air around the tunnel circuit in a counter-

Fans propel air at controlled speeds around the wind tunnel and through the scale-model test section.



G-5418



CORNELL AERONAUTICAL LABORATORY

Cutaway view of a 12-foot (3.6-meter) variable-density, high-speed wind tunnel for aeronautical research.

clockwise direction. Through the large-diameter sections of the tunnel, the airspeed is quite moderate. The energy losses at the corners are minimized by turning vanes. The water-cooled radiators are required to eliminate the temperature rise from the heat of compression generated by the fan blades. As the test section is approached, the cross-sectional area is contracted to about one eighth of the upstream area. Because of this contraction, the airspeed increases to about eight times its upstream value as it flows through the test section where the model is mounted. At the end of the test section, the air slows down again in the diffuser, which is connected to the fan section, thus completing the circuit.

**Subsonic Tunnels.** In a subsonic tunnel the velocity in the test section is so low that the air can be considered incompressible—that is, the density of the air remains essentially constant throughout the flow field. Most of the early tunnels were of the open-circuit type; however, more modern subsonic tunnels are closed circuits. A relatively small amount of power is required in the subsonic wind tunnel, but it must be accurately controlled because the air velocity in the test section is directly proportional to the pressure ratio.

**High-Speed Tunnels.** Higher speeds may be attained in the subsonic wind tunnel by increasing the power provided to the fans or compressor. As the speed of the airstream increases above 400 miles (645 km) per hour, but still less than the speed of sound or Mach number 1, the air can no longer be treated as an incompressible medium because the air density no longer remains constant throughout the flow field. These are known as "high-speed wind tunnels."

The additional speed that may be obtained by increasing power is limited. The airspeed in the area of minimum contraction, or throat, will not exceed the speed of sound. When this speed is approached, the test section "chokes," and further increases in pressure will not increase the test-section velocity. Furthermore, the introduction of even a small model in the test section establishes a new throat that slows the air in the free stream ahead of the model.

**Transonic Tunnels.** The problem of alleviating choking near sonic velocity in high-speed wind tunnels proved a major stumbling block in the development of wind tunnels. Extensive research ultimately proved that tunnel choking could be essentially eliminated by cutting several stream-wise slots in the test-section walls and encasing the unit in a tank or plenum chamber. Perforating the test-section walls with small holes (equivalent to approximately 20% porosity) accomplished the same purpose, and was even more successful in eliminating the troublesome reflected shock waves at the low supersonic Mach numbers. These shock waves, or pressure discontinuities, emanate from the nose of the model, rise almost vertically to the flow direction, reflect from a solid wall of the tunnel, and impinge on the model aft of the nose. This would create an error that has no physical counterpart in free flight, but, with a perforated wall, the pressure disturbance can pass through the wall into the low-pressure plenum that surrounds the test section.

**Supersonic Tunnels.** The fundamental difference between a subsonic and a supersonic wind tunnel is that any speed may be produced at the test section of a subsonic tunnel without altering



the shape of the rest of the channel. In a supersonic wind tunnel, however, the speed in the test section is determined by the geometry of the channel—that is, the ratio of the test section to the throat area. The channel between the throat and the test section must be expanded with great precision to attain homogeneous supersonic velocities in the test section. The air travels at approximately 50 miles (80 km) per hour in the stilling section and then it accelerates to sonic velocity in the throat of the nozzle. From this point, the nozzle expands once more to a size that provides the desired supersonic speed in the test section.

**Hypersonic Tunnels.** Supersonic wind tunnels that operate at greater than five times the speed of sound (Mach number 5) are usually referred to as hypersonic wind tunnels. In a tunnel with a given throat area, the Mach number increases with the expansion of the walls of the nozzle. Although the mass flow of air remains constant through the throat, the compression ratio of the air drive must increase as the Mach number increases. If the stagnation temperature of the air is constant, the ambient temperature in the test section decreases as the Mach number increases until the air liquefies, after which experimental results are no longer valid. The stagnation temperature of the air must therefore be high enough to prevent condensation.

To obtain true simulation, the inlet air should be heated until the ambient air temperature in the test section approaches the normal temperature of the atmosphere through which the craft will fly. At Mach number 12, the stagnation temperature in the stilling section must be about 8500° F (4700° C) for the ambient temperature in the test section to remain above 0° F (18° C). The maximum air temperatures obtainable with pebble-bed storage heaters is about 3000–4000° F (1650–2200° C). Higher temperatures can be obtained by discharging vast quantities of stored electrical energy into a volume of air, separated from the test section by a diaphragm, until the heat and pressure rise sufficiently to rupture the diaphragm and the high-temperature air rushes through the nozzle throat into the test section. Such discharges result in usable test times of a few hundredths of a second.

Another device for obtaining high-temperature flows of extremely short duration is the shock tube, a length of pipe containing air under pressure. A compartment at one end of the tube, separated by a diaphragm, is filled with a light gas, such as helium or hydrogen, at very high pressure. When the diaphragm is ruptured, the gas discharges against the air, heating and accelerating it much as it would in a high-speed piston.

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**WINDAUS**, vin'dous, **Adolf** (1876–1959), German chemist, who was awarded the 1928 Nobel Prize in chemistry for his research on sterols and their connection with vitamins. He was born in Berlin, Germany, on Dec. 25, 1876. After studying at the universities of Freiburg and Berlin he taught at Freiburg and Innsbruck and at Göttingen, where he was also head of the Chemical Institute from 1915 to 1944. He died in Göttingen on June 9, 1959.

Windaus established that ergosterol could be activated by ultraviolet light into vitamin D<sub>2</sub>,

an agent in the prevention and cure of rickets. His researches into the structure of cholesterol had fundamental consequences in the study of sex hormones, and his work on digitalis led to the development of various drugs for the heart.

**WINDBREAK**, a barrier of trees, shrubs, or both planted to break the force of the prevailing wind. Windbreaks are used widely to prevent wind erosion of the soil, but additional uses have also been developed. In cold climates, they may reduce by about 15% the amount of fuel required for home heating, and they protect livestock from adverse weather. They hold and store snow in winter, increasing soil moisture after the spring melting and resulting in more vigorous vegetation over the protected areas. Roads may also be kept free of snow by windbreaks. They are used to protect orchards during pollination and fruit-ripening periods, and conservationists use them as nesting sites for birds and to provide food and travel lanes for wildlife. Windbreaks planted in series, called shelter belts, are able to modify local climate.

The trees afford shelter for a distance of about 20 times their height. While barriers of ten rows or more may be used, they are usually not as effective as a single row of shrubs combined with a row of trees, which constitutes a semipermeable windbreak that slows the wind and permits part of the air to pass through slowly, rather than forcing all of it upward in eddy currents.

Eastern red cedar, Ponderosa pine, and Austrian pine are conifers that are widely used for windbreaks under all conditions. In semiarid climates and on soil of limited moisture-holding capacity, bur oak and Osage orange are used. Green ash, American elm, and honey locust grow satisfactorily only under conditions of somewhat higher soil moisture. Catalpa, black walnut, cottonwood, sycamore, and willow are satisfactory only on deep soils with high water tables. The planting sites must be plowed and cultivated to produce an adequate seedbed. Subsequent cultivation is usually necessary for five years or until the trees shade out weeds. Grazing animals, which may browse the trees and shrubs or kill them by trampling on the soil, must be fenced out.

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**WINDHAM**, win'dəm, a town in Connecticut, in Windham County, in the eastern part of the state, 27 miles (43 km) east of Hartford. The principal drainage system of the town's area (27.9 square miles, or 72.5 sq km) is formed by the Willimantic and Natchaug rivers. The topography consists of broad valleys and moderately rolling hills.

The town includes the city of Willimantic and the village of Windham. Except for the industrial activities in these centers, it is residential and agricultural. Principal industries in the centers mentioned are the manufacture of paper-mill machinery, screw-machine products, thread, radio components, tool chests, vises, screws, bolts, and wire insulation. Following the usual colonial pattern of industrial development, gristmills and sawmills were the beginning of Windham's industries. In 1806 a factory for wool processing was established, and in 1854 the manufacture of thread was begun.

Named after Windham, England, the town was incorporated in 1892, only six years after the colonists first settled there permanently. Windham is noted for the curious Revolutionary War relic the "Bacchus of Windham," a wooden statue carved by British sailors imprisoned here in 1776. Government is of the selectmen-town meeting form. Population: 22,039.

**WINDHOEK**, *vin'thōök*, is the capital and largest city of South West Africa (Namibia), located 253 miles east of Walvis Bay at an altitude of 5,428 feet. Established in 1890 as a military station, it was named Windhuk in 1892 when the territory became German Southwest Africa. In 1915 it was occupied by the forces of the Union of South Africa and, after World War I, became the administrative center for the League of Nations mandate of South West Africa, which continues to be administered by South Africa. The townspeople are trilingual, speaking Afrikaans, German, and English. Dairying, cabinet-making, engineering, and brewing are among its industries, and its red and white wines are famous. The surrounding area is the principal farming district of South West Africa. With rail and air services, the town is also a commercial and distributing center. Natural hot springs are nearby. Windhoek's public buildings include a museum, library, and archives. Population: (1970) 61,260.

**WINDIGO**, *win'di-gō*, a northern Algonquian term, referring (1) to a race of giant cannibals in the mythology and folklore of the Indians of the northern Great Lakes area, and (2) to a generalized character disorder suffered by Indians of this area. Windigoes are regarded as personifications of an evil spiritual force associated with winter and starvation. Besides their gigantic stature and insatiable craving for human flesh, they are described as having emaciated bodies, hearts of ice, and twisted mouths from which issue thunderous roars and terrifying whistles. They are also endowed with prodigious strength and certain supernatural powers.

According to native belief, human beings can be transformed into Windigoes in three principal ways: (1) through anthropophagous acts, committed under duress of starvation, inducing a chronic addiction to human flesh; (2) through the visitation of a Windigo spirit during a dream or vision; and (3) through the machinations of a vengeful sorcerer. The common prodromal symptoms of Windigo disorder include anorexia, vomiting, insomnia, and melancholic withdrawal into oneself. It is felt that the sufferer can be cured during the initial stages; but the more advanced stages, characterized by perceptual distortions in which other persons are seen as edible animals and by outbursts of violent antisocial behavior, are considered beyond native therapy. When the violent stage is reached, the afflicted person is killed by the community, and the corpse is usually chopped to pieces and burned to melt the icy heart and forestall resurrection. Although belief in Windigoes is widespread among these Indians, the incidence of the disorder is quite low. The syndrome overlaps with many separate diagnostic categories employed by modern psychiatry.

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**WINDMILL**, a machine that uses the energy of the wind to produce power. At least since the Middle Ages windmills have been used to produce mechanical power for such tasks as grinding grain or pumping water for irrigation. In Holland they have been used for pumping water to reclaim land from the sea. Windmills still are significant power sources in developing countries of the world but play a small role in industrialized countries. The first windmill used as a source of electric power was built in Denmark in 1890. Since then, wind-powered generators have been used to provide electric power to individual homes and farms, but little has been done to exploit the energy of the wind to give it a significant role in meeting energy needs.

**Wind-Energy Resources.** Winds, unlike fossil fuels, are a renewable source of energy. Studies at Oklahoma State University indicate that by building wind-energy conversion systems inland and offshore, the United States could generate an estimated  $1.54 \times 10^{12}$  kilowatt-hours (kwh) of electric energy annually by the year 2000. This would amount to 5% to 10% of the country's projected total electric power needs. It would take about 2.2 billion barrels of oil per year to generate the same amount of electrical energy.

Three moderately high-wind areas offering promise for the development of wind power in the United States are the Atlantic coast, the Great Plains, and the Pacific coast.

The design and operation of a windmill depend on characteristics of the wind—notably wind speed and changes in wind speed, wind direction and changes in wind direction, wind turbulence, and the height of the wind above the ground.

Regions where the average wind speed is high—15 to 25 miles (20–40 km) per hour—and where there is a prevailing wind direction are favorable for windmills. Light winds—less than 5 miles (8 km) per hour—will not start up a windmill. Strong winds, such as those of a hurricane, are too hazardous for the safe operation of a windmill.

Wind turbulence, which is unfavorable for windmills, generally is more prominent near the ground than at greater heights because of uneven terrain or other factors that tend to break up a smooth flow of air.

In general, the greater the height above the ground at which the wind is blowing, the greater the wind speed. This characteristic stems from the fact that retardation of the wind by ground friction decreases with increasing altitude.

**Windmill Design.** The essential feature of a windmill is a rotating member driven by the wind. Generally, the rotating member carries sails or consists of metal vanes or propeller blades, although other designs for extracting energy from the wind have been used.

All windmills can be put into two classes—the horizontal-axis windmill, which includes the post, tower, metal vane, and propeller types, and the vertical-axis windmill, which includes the Persian windmill, the Darrieus rotor, and the S-rotor. In the former class the shaft of the rotating member is horizontal or nearly horizontal, whereas in the latter class it is vertical. A horizontal-axis windmill must be provided with some means to point into the wind for maximum power generation, whereas a vertical-axis windmill operates independently of the wind direction. (In the literature the terms "horizontal

windmill" and "vertical windmill" are sometimes used. A horizontal windmill is a vertical-axis windmill, and a vertical windmill is a horizontal-axis windmill.)

**Windmill Power and Efficiency.** The power in a wind striking a windmill is proportional to the cube of the velocity of the wind,  $V^3$ , the square of the diameter of the windmill's rotating member,  $D^2$ , and the density of the air,  $\rho$ .

The power output of a windmill depends on  $V^3$ ,  $D^2$ ,  $\rho$ , and various other mechanical and aerodynamic factors. For a propeller windmill, these include blade angle, blade twist, ratio of blade area to area swept by the blades, angle between the wind and the propeller rotation plane, the ratio of the wind velocity to the rotational velocity of the blades (the tip speed ratio), and the weight of the rotating parts. A propeller windmill has an efficiency of about 40%; a Darrieus-type rotor, 40%; an S-rotor, about 30%; a multivaned windmill, 15% to 30%; and a Dutch windmill, 5% to 10%.

All of the power in a passing wind cannot be intercepted and extracted by a windmill because the wind speed downwind of the windmill would then be zero, which is impossible. About 1920 the German aerodynamic engineer Albert Betz first showed that no windmill can extract more than 59.3% of the wind energy passing through the area swept by the windmill blades. In practice, the efficiency of a windmill in converting wind power to the mechanical power of a rotating shaft is limited to about 42%. When used with a generator to supply electric power to a user, the overall efficiency in converting wind power to electric power is about 30%.

**Wind Power for Home and Farm.** Small-scale wind-power systems suitable for providing electricity or mechanical power for rural homes or farms are commercially available. A small-scale system generally includes a propeller and dc generator rated in the range from about 50 to 6,000 watts, a tail vane to keep the propeller rotation plane perpendicular to the wind direction, a steel tower 10 to 100 feet (3-30 meters) high, a set of 20 or more lead-acid storage batteries charged by the generator to provide electric power when there is little or no wind, and an inverter that converts dc to ac. Such a system is considered practical in areas where wind speeds average 8 miles (13 km) per hour or more.

A 6-kilowatt wind generator has an output of 325 kwh per month in an area where the average wind speed is 10 miles (16 km) per hour. It can supply enough power to meet all the electrical needs of a modern household except for cooking and heating, which can be done with gas. Such an installation requires about 75 storage batteries to provide electricity during windless times.

In the early 1970's in the United States, the complete installation cost for a 2-kilowatt system was about \$1,400 per kilowatt of capacity. The cost of wind-generated electrical energy is in the range from 10 to 25 cents per kwh, depending on wind conditions, cost of equipment, and interest rates. This range includes the cost of batteries for energy storage and an inverter. Where an ac generator is used to provide power directly, such as to water-pumping equipment for irrigation, the cost can decrease to about 5 cents per kwh. For comparison, an electric power station generator costs about \$150 per kilowatt of capacity, and the electricity to the user costs 3



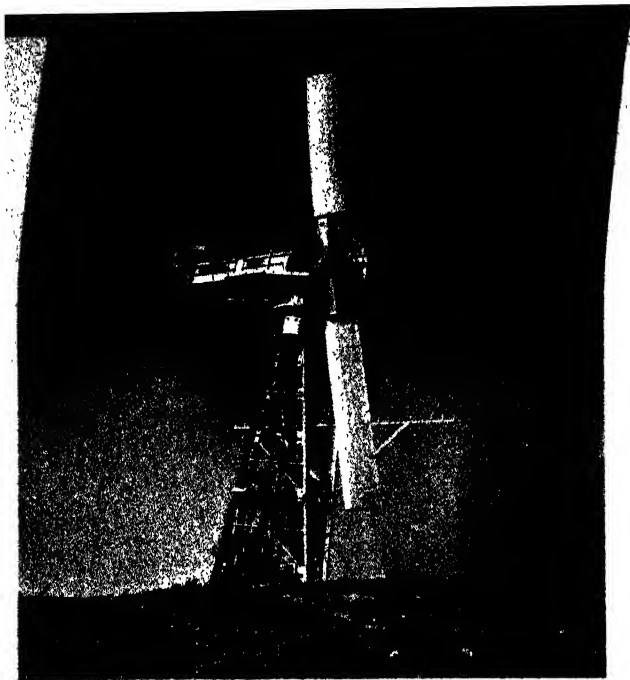
CONSULATE GENERAL OF THE NETHERLANDS

(Above) ROW OF TOWER WINDMILLS, Leidschendam, Netherlands. The mill in the foreground has the sails on its arms furled. (Below) Multivaned windmill atop a wooden tower is used on a Texas farm to pump water.

BRANT HEILMAN







WIDE WORLD



ARTHUR OLLMAN, SOLAR WIND  
SMITH-PUTNAM 1,500-kilowatt wind generator was built in Vermont in 1941. Its blades span 175 feet (left). Six-kilowatt wind generator atop tower in Maine provides home electricity (above).

to 8 cents per kwh. The cost of power generated by a home diesel or gasoline generating set is about 30 cents per kwh.

For use on farms, an alternative to the storage battery is under development. In this system, electricity from the wind generator is used to dissociate water, thereby producing hydrogen and oxygen gases. These gases are stored for later use in a fuel cell, internal-combustion engine, or burner.

**Large-Scale Wind-Powered Systems.** Large-scale wind-powered systems are attractive because they do not cause air, water, or thermal pollution; are virtually free of noise when operating; and require little maintenance and no fuel. According to William Heronemus of the University of Massachusetts, wind-powered systems have the greatest chance of being used to supply an important part of the U. S. energy needs in the near future at costs that are competitive with other systems.

To tap wind power on a large scale, Heronemus proposed the erection of 15,000 towers on the Great Plains, spaced as closely as one per square mile (2.6 sq km). Each tower would carry 20 wind turbines, making a total of 300,000. Each wind turbine would consist of a two-bladed propeller with a 50-foot (15-meter) diameter, tip to tip, and each would drive a generator connected to an electrical network. Such an array on the Great Plains could provide the equivalent of an installed capacity of 189,000 megawatts, or nearly half of the total installed capacity of electric power plants in the United States in the mid-1970's.

Heronemus also proposed that large arrays of wind generators be based at sea, where powerful winds provide a good source of power.

#### EARLY WINDMILLS

**Persian Windmills.** The origin of the windmill is obscure, but records indicate that it was in use in Persia in the 10th century, perhaps even as early as the 7th century. In a Persian windmill the sails revolved on a vertical axis. The wind was directed onto the sails through slots in a wall surrounding the windmill. The Persian

design was transmitted to China, perhaps by 1200 A. D. The Chinese discarded the enclosing wall and improved windmill operation by using sails that feathered. Such a windmill was used mainly to lift water for irrigation.

**European Windmills.** In Europe the earliest windmills appeared almost simultaneously in France and England toward the end of the 12th century. These windmills, which typically had arms mounted on a horizontal or nearly horizontal axis, almost certainly were invented independently of Persian or Chinese designs. They were used mainly for grinding grain or pumping water.

**Post Mill.** The earliest windmill in France and England was the post mill. It had a box-shaped wooden body that carried sails on a nearly horizontal shaft. The body and roof of the windmill were supported by a horizontal beam that rested across a well-supported central vertical wooden post. The horizontal beam was pivoted on the vertical post and thus was free to rotate in a horizontal plane. The whole structure of the windmill was turned by means of a tail pole attached at the back side of the windmill. The miller set his shoulders to the tail pole and slowly walked the whole windmill around until the sails faced into the wind.

Use of the post mill spread through Germany, Holland, and other parts of northern Europe by the end of the 12th century, and it became established in southern Europe a few centuries later. The post mill remained in use for hundreds of years. The earliest examples still standing date from the early 17th century.

**Tower Mill.** The tower mill was invented in Europe early in the 15th century. It had a stone or brick tower and a timber roof, or cap, that contained the shaft on which the sails revolved. The sails were faced into the wind by rotating the entire cap on a circular wooden track or, later, on wooden or metal rollers. This was done by the miller, who moved a tail pole connected to the cap. Some of the finest tower mills were built in Holland, where many still stand. They survived in greater numbers than the post mills because their bodies were made of brick or stone rather than of wood.

A typical Dutch gristmill stood about five stories high and had a windwheel consisting of four sail frames, each about 30 to 40 feet (9-12 meters) long. Canvas sails, stretched over the wooden frame, were set at an angle to the plane of the windwheel of about 18° at the inner end, gradually decreasing to about 7° at the outer end. The cap, comprising the upper 12 feet (3.7 meters) of the mill, revolved on a turntable, which enabled the miller to change the position of the windwheel by operating a windlass controlled from a platform at the second-story level. A friction brake band, controlled from the same platform, stopped and started the machinery. A fly governor on the fourth story automatically regulated the speed and braked the machinery if the wind became too strong for safe operation. Levers adjusted the pressure between the two grinding stones and acted as an additional brake.

The nearly horizontal shaft of the windmill was connected by gearing to a vertical shaft, at whose bottom was more gearing for driving the upper grindstone. The grain was crushed on the first floor before being lifted by buckets to bins on the third floor, where it was cleaned by fans. It was then carried through chutes to the grinding stones on the second floor. The ground meal passed through chutes to the first floor where it was sifted through various grades of silk and stored, according to its texture, in bins. The capacity of such a mill was 20 to 40 barrels of meal per day.

The post mill developed 2 to 8 horsepower, and the tower mill 6 to 14 horsepower. Despite their relatively inefficient use of power, windmills were used in large numbers until the development of the steam engine, the internal-combustion engine, and the electric motor. In Holland about 9,000 windmills were in use in the mid-19th century. Of these only about 950 remain, including about 100 that are still workable.

#### MODERN WINDMILLS

**Multivaned Windmill.** The multivaned windmill, developed in the United States in the last half of the 19th century, consists of a number of small metal vanes set radially in a wheel. It was widely adopted by the end of the century, and thereafter its use spread through the world.

As standardized, it has a windwheel 8 feet (2.4 meters) in diameter with many steel blades set radially close together. Mounted on a steel tower about 35 feet (10.7 meters) high, this windmill is usually geared to a pump that can be detached and operated by hand. The mill can pump water from great depths for livestock, irrigation, or household use.

During the early 20th century, a steel-tower multivaned windmill rose above nearly every farm in the Midwest and West, but the rapid advance of rural electrification during the 1930's eliminated most of them. However, they still remain in use in India and other developing countries.

**Propeller Windmill.** The propeller windmill, generally having two or three blades, came into use following the development of the airfoil propeller for aircraft in the 1920's. The propeller windmill typically is used in conjunction with a generator to provide electricity in isolated rural areas. Small propeller windmills provide electric power to a home or farm. Large propeller windmills are experimental or under development. They provide electric power to a distribution network, as does an electric power station.

Beauchamp E. Smith, Palmer C. Putnam, and co-workers pioneered the development of the large propeller windmill. They built and operated a 1,250-kilowatt wind turbine and generator unit that delivered electricity to the network of the Central Vermont Public Service Corporation during 1941-1945. The wind turbine had two stainless-steel blades and diameter of 175 feet (53.3 meters) from tip to tip. The turbine and generator were mounted on top of a 110-foot (33.5-meter) tower, which was located at the summit of Grandpa's Knob, a 2,000-foot (610-meter) hill near Rutland, Vt. This wind turbine lost a blade and was shut down in 1945.

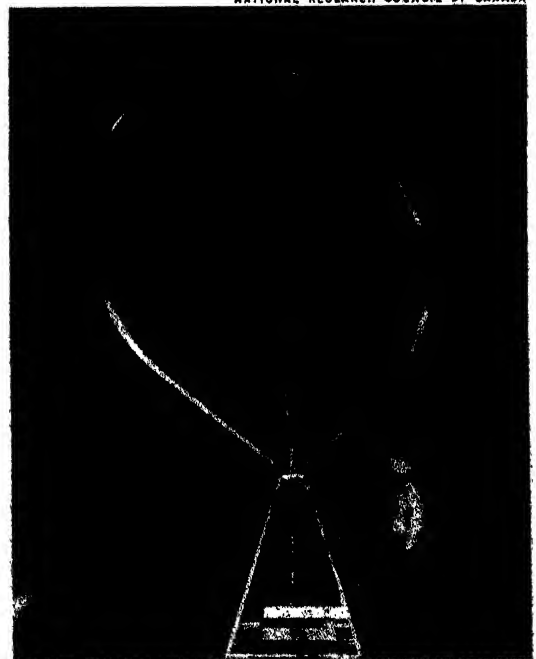
In the mid-1970's several organizations, including the Aerowatt Corporation in France and the National Aeronautics and Space Administration (NASA), were pursuing the development of large wind-generator systems. NASA plans to build and test an experimental 100-kilowatt windmill with two blades that span 125 feet (38 meters) from tip to tip. Even larger systems of this type are envisaged for the most extensive exploitation of wind-power resources.

**Vertical-Axis Wind Turbines.** The Finnish engineer S. J. Savonius patented a vertical-axis wind turbine in 1929. This machine, called an S-rotor, can be visualized as being formed by slicing a vertical hollow cylinder in half from top to bottom and then moving one half sideways until its trailing edge points at the middle of the other cylinder half. With this design, one half of the S-rotor is convex to the wind and the other half is concave. The side that is convex to the wind is rotated by wind spilling from the side that is concave to the wind. One leader in the development of the S-rotor in the 1970's was the Elektro G.m.b.H. firm of Switzerland.

The French engineer G. J. M. E. Darrieus patented a vertical-axis wind turbine in 1931. It

**VERTICAL-AXIS WIND TURBINE of the Darrieus type is tested in a wind tunnel in Canada.**

NATIONAL RESEARCH COUNCIL OF CANADA



consisted of two slender semicircular blades, both attached to the top and bottom of a vertical shaft. The Darrieus rotor was independently reinvented by the National Research Council (NRC) of Ottawa, Canada, in the early 1970's.

**Further Reading:** Baker, T. Lindsay, *A Field Guide to American Windmills* (Univ. of Okla. Press 1985); Johnson, Gary L., *Wind Energy Systems* (Prentice-Hall 1985); Powell, F. E., *Windmills and Wind Motors* (Lindsay Pub. 1985); Seiler, Farrell, S., ed., *Windmills and Windpumps* (Windbooks 1986); Wailes, Rex, *Windmills and Watermills* (State Mutual Bk. 1981).

**WINDOW**, wīn'dō, an opening in the wall of a building designed to admit light and air. The admission of light is accomplished through the use of transparent or translucent panes; ventilation, by opening the sash to the outside air. The frame in which a window is set is a *casing*. It has a *sill* at the bottom, *jamb*s at the sides, and a *lintel* as a straight, horizontal member at the top, or the head may be arched or pointed. The *sash* is the movable part of the window and is called a *casement* if it opens on hinges at the side. It is glazed with *panes*, or lights, usually of transparent glass, but the panes in church and cathedral windows are commonly of stained glass, and in buildings where a diffused light is preferred, or where visibility from the outside is undesirable, they may be frosted or tinted. The pane may completely fill the sash in which it is set, but several smaller ones are frequently used instead of a single sheet. They are separated by slender wooden, metal, or lead bars, the vertical divisions being called *mullions*, the horizontal ones *transoms*. These bars are sometimes less correctly referred to as muntins or muntings, a corruption of *montant* mullion. When the bars radiate from the center, the window is known as a *wheel*, or as a *rose window* if of stained glass, as in a church.

**Rise of Metal in Window Construction.**—The development of new construction methods and materials has greatly increased the importance of windows in architecture. Where before 1945 modern window sashes and casings were made almost exclusively of wood, a growing proportion have since been constructed of aluminum, steel, and stainless steel. Use of comparatively narrow strips of these metals, in place of wider wooden members, has permitted an increase in the size of glass panes, thus increasing the size of the opening to light and air. Metal window sashes and casings were first tried in schools, hospitals, and other public buildings, but low maintenance costs, especially of aluminum, which requires no repainting because of resistance to rot and rust, soon made them popular for commercial and industrial structures and also for residential construction. The entire walls of some office and factory buildings are now made of glass, much of it double glazing to create a dead-air space between the twin panes and prevent loss of heat during cold weather.

**Types of Windows.**—Windows in common use are of several types, depending upon the style of architecture and the taste or preference of the builder. Perhaps still the most popular is the *double-hung window*. It has two sashes that slide up and down with the aid of weights on cords or chains running over pulleys at the top and concealed in pockets inside the casing. More modern hardware includes spring clips that hold the sash in place by compression against the jamb. *Casement windows* are hinged vertically

at the sides and usually open outward, manually or by means of a crank or handle operating a simple chain of gears, although they may be hinged to open inward instead. *French windows* reach to the floor, for which reason they are also called French doors. They usually open inward. *Awning windows* consist of three or more horizontal sashes hinged at the top so that they open outward, acting as awnings to keep out rain when open. They are usually controlled from the inside by means of a crank, some being arranged so that all sections open or close simultaneously; in others a delaying action allows the bottom unit to open part way before the upper sections move.

*Hopper windows* are hinged at the bottom and open inward. *Bay windows* are three or more windows, frequently double hung, with the outer pair at an angle to the wall from which they project outward. If they are curved to form an arc of a circle, they are called *bow windows*. Properly speaking, bay and bow windows appear only on the ground-floor level; on upper floors they are known as *oriel*s. A *dormer window* is one placed at a right angle to a pitched roof and covered by a small pitched roof of its own. *Fixed windows* are those with a sash that does not open. Especially when large and opening on a view, they are known as *picture windows* and have become very popular in the design of modern homes. They are frequently flanked by narrow casement windows or others that will open to provide ventilation, but if the room is air conditioned, this is not important. A *window wall*, as the name implies, is an entire wall, sometimes of basic windows, sometimes of glass panels, some of which may be arranged to slide horizontally for entry to a terrace or patio; or the wall may be built of glass brick.

*Sliding windows* with wall space between sill and floor were originally designed for ranch-style and other modern houses where the accent is on the horizontal, but now they are considered compatible with many types of architecture. *Jalousie*, or louvered, windows consist of multiple horizontal glass slats, or louvers, fixed on pivots at the ends so they can be opened to any angle like venetian blinds. They overlap slightly when closed. Somewhat wider slats are pivoted vertically and are classed as *pivoted windows* or *solar shades*. Some are controlled by sun-powered motors. Another style still found in modern buildings is the *clerestory*, a shallow window or row of windows installed at the top of a wall under the roof line.

See also GLASS; GLASS AND GLASSWARE; STAINED GLASS.

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#### HISTORY

Windows played but a minor role in Egyptian houses. They were small and set high in the wall, more for ventilation than for light. However, the hypostyle halls of such large Egyptian temples as Karnak had clerestories at the top of the central aisle for lighting. Greek temples were lighted only through the door, and in houses the rooms opened on courtyards and needed no further light. The more complex imperial Roman buildings, like basilicas and baths, often had large lunettes under the vaults, perhaps subdivided by mullions. Windows, though



still small, became more numerous in the clerestories of Early Christian basilicas and later in Byzantine architecture. A ring of such windows at the base of the dome in Hagia Sophia, Istanbul, bathes its interior in soft light. In all these styles, the windows were little more than holes in the wall. Thin slabs or grills of translucent alabaster might exclude rain, but in most cases the windows were left open. With the Romanesque style of the 11th and 12th centuries in western Europe, moldings began to enframe the windows and thus add to their prominence.

The window came into its own in the Gothic style beginning in the late 12th century. Its great cathedrals were cages of glass and stone with windows replacing the wall from buttress to buttress or pier to pier. The glass was set in the center of the wall, and moldings or colonnettes adorned the diagonal splay of the arches or jambs inside and out. Since the lead bars that held the small pieces of stained glass were weak, stone mullions were needed to subdivide the window and to support the patterns of tracery within the arch. Especially in the late Gothic, elaborate patterns were popular.

In houses, the size and location of windows were determined by the rooms they lighted. Vertical mullions and horizontal transoms subdivided the larger windows. During the earlier Middle Ages, shutters closed such windows, though panels of horn or wooden lattices may have been used. By the 15th century in northern Europe, glass began to appear in houses, usually only in the upper part of the window with shutters for the lower part.

Though smaller than the Gothic, windows in the Italian Renaissance of the 15th and 16th centuries remained of substantial size. They were evenly spaced and arranged to produce a symmetrical design. The jambs were often molded, or the window enframed with pilasters or engaged columns. Cornices or pediments were set above them. Such windows were features in the design of the building.

The sashes of Gothic and Renaissance windows were invariably casements. The first certain appearance of the double-hung sash occurred in England late in the 17th century, and it rapidly replaced casements thereafter. The panes were small in size because of the difficulty of procuring sheets of glass of uniform thickness. Hence many panes were needed for each window. As methods of glass production improved during the 18th and 19th centuries, the size of the panes increased, and the number per window declined. Thus a window of 1730 might have 18 or even 24 panes, while one of the same size in 1830 would have only 4. This trend ultimately led in the 20th century to the single pane picture window and even to the window wall. In this last case, the windows, although still forming part of the design of the building, have lost the individual prominence of Gothic or Renaissance windows.

See also STAINED GLASS.

EVERARD M. UPJOHN  
*Author of "History of World Art"*

**WINDOW BOX**, a container filled with plants, which normally rests on a windowsill but can be attached as well to the building below the window. A window box gives people the possibility of having a small garden in a confined area, when they have no other ~~places~~ to plant, for very little

expert knowledge and effort. It has been traditional in Britain and Europe in general to have billowing and floriferous window boxes cascading with plants adorning apartment windows, houses, storefronts, restaurants, and even service stations.

The average window box is 36 inches (90 cm) long, 8 inches (20 cm) high, and 8 inches wide, but it can be made or bought to fit the actual size of your window ledge. The box should not exceed 4 feet (1.2 meters), as it would become unwieldy and dangerous otherwise. It can be made from different rot-resistant woods such as redwood, cedar, teakwood, clean pine (without knots), or plywood treated with a noncreosote wood preservative that will not harm the plants by leaching into the soil. Other possibilities include cast stone, lead, concrete, terra cotta, fiberglass, plastic, or metal. The last two, however, are not always the best choices as they tend to heat up.

If you do not buy a ready-made box but build one, keep in mind the importance of reinforcing the corners securely either by screwing the corner edges together with galvanized screws (nails have a tendency to pop out over a period of time) or with angle irons attached to each corner. The wood should be at least 1 inch (2.5 cm) thick for insulation purposes, and a number of drainage holes should be drilled into the bottom of the box.

Plants may be planted in good potting soil, mixed at home or bought in a store, or individual pots with plants in them may be placed in the box with sphagnum moss acting as a mulch for insulation purposes. If planted, leave at least  $\frac{3}{4}$  inch (2 cm) from the top of the soil line to the top of the box so the soil does not spill over the side when watered. Pack in the plants as close as possible to give an immediate effect of fullness to the box as well as to produce an abundant bloom. All boxes should have drainage materials (crock, pebbles, etc.) at the bottom to ensure proper drainage.

Since window boxes are not just an architectural feature but are filled with living things, they should be watered on a regular basis. Because of window overhang above, rain normally will not water boxes. During the height of the season, boxes should be checked for watering daily. Water thoroughly, going from end to end over the entire soil surface, and make sure to give enough water to have it pour out the drainage holes. Plants can be fertilized every two weeks during the height of the season. Make sure boxes are attached either to the windowsill or window frame securely.

For sunny and hot exposures the top choices are geraniums, marigolds (lower French variety), petunias, lantana, verbena, wax begonias, miniature snapdragons, Madagascar vinca, phlox, and portulaca. For partial shade, lobelia, Madagascar vinca, fuchsia, coleus, and caladiums are to be recommended.

For the front of the box, to create a spilling over, cascading effect use English ivy or periwinkle, either regular or variegated spider plants, asparagus fern, ice plants, or ivy-leaved geraniums. As an added treat, attach a trellis to the back of the box and run up it climbing plants such as morning glory, black-eyed Susan vine, or scarlet runner bean.

MAGGY GEIGER  
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**WINDS**, air motion over the ground. A wind has a direction and a speed. The familiar weather vane is one way of measuring wind direction. Wind speed is usually measured by an instrument called an anemometer. The measurement of wind speeds aloft is often made by radar tracking of weather balloons or sensors on aircraft. Measurement by radar and satellites is also becoming more common.

The crews of the early sailing vessels had keen weather eyes. Those who ignored the winds perished. The early seafarers learned to measure the winds by observing the state of the sea or the sky. The familiar refrain "red sky in the morning, sailors take warning; red sky at night, sailors' delight" is one such example.

Today, experienced sailors can make good estimates of the wind by using the Beaufort wind scale, which is based upon the state of the sea surface. (See **BEAUFORT SCALE**.) A common measure of wind speed is the knot (kt). One knot represents a speed of one nautical mile per hour. There are 60 nautical miles in one degree of latitude. Therefore, a balloon carried along by a 30-knot north wind will move southward 60 nautical miles, or one degree of latitude, in 2 hours. (One knot is equal to 1.15 standard miles, or 1.85 km, per hour.)

### 1. Winds and Human Activity

Winds affect human life in many ways. Wind-driven waves on the ocean may reach enormous heights of 32 to 65 feet (10–20 meters). A so-called rogue or "freak" wave triggered by an unexpected squall (strong wind with speed of 25 to 30 knots or more lasting for at least two minutes), may have been responsible for sinking the *Pride of Baltimore* in the Caribbean in April 1986. The storm surge (wind-driven water) that accompanies a hurricane crossing a coastline may destroy nearly every beachfront dwelling, particularly at high tide. In August 1969, a storm surge of 23 feet (7 meters) above normal high tide with the landfall of hurricane Camille caused about a billion dollars of damage along the gulf coast and killed many people.

Locusts and grasshoppers have plagued farmers since the dawn of human civilization. Wind-borne swarms of these insects will eat their way through all crops in their path. Accurate forecasts of wind direction and speed are crucial to controlling these plagues, especially in Africa where the swarms may cover thousands of square kilometers.

Just as the wind may carry insects long distances, so it may carry pollen or pollution particles. In 1883 the island of Krakatoa in the Pacific was destroyed by a titanic volcanic eruption. The return of plant and animal life to the remnant of the destroyed island has been helped by wind-borne pollen and insects from nearby land areas. Similarly the wind carries pollution particles thousands of kilometers from their source regions. The acid rain that falls over much of the industrialized world is one example of this process. And in a tragic example of the power of wind movement, radioactive debris from the meltdown of the Chernobyl nuclear reactor in the Soviet Union in April 1986 was carried westward and northward by the wind across parts of Europe.

**Wind Speeds.** Everyone has felt the power of the wind. The force that one feels on the body from the wind is approximately proportional to

the square of the wind speed. Double the wind speed and the wind feels four times as strong. A gentle 10-knot breeze is enough to keep leaves moving on trees and stir whitecaps on water. Entire tree branches sway with a 20-knot wind, and spray is kicked up on water surfaces. Winter rain and snowstorms commonly produce winds of 30 knots. At such velocities walking becomes difficult and trash barrels are littered with destroyed umbrellas. Severe winter blizzards may produce winds of 50 knots or more, strong enough to knock a person over and cover recently plowed roads with snow drifts. Many objects, including people, can become airborne with a 100-knot wind.

Topographic features may contribute to very high wind speeds as air flows downhill or funnels through a narrow canyon. Cold air moving rapidly downward from highland regions was responsible for a severe Arctic windstorm at Thule, Greenland, on March 8–9, 1972, that produced extreme gusts of 180 knots. In the United States, Boulder, Colo., is famous for its high winds in winter that sometimes reach 100 knots as air rushes down the Rocky Mountains onto the plains below. America's Mount Washington, in the state of New Hampshire, is famous for high winds. Indeed the fastest wind ever recorded on the surface of the earth occurred there on April 12, 1934, when a wind gust reached 201 knots. Over level ground the fastest wind ever measured occurred at Chetumal Airport in Mexico on Sept. 27, 1955, during Hurricane Janet. The anemometer recorded a peak gust of 150 knots before it blew away!

The measurement of high winds is very difficult. Most anemometers do not work very well once the wind speed reaches 100 knots. Even a very sturdy anemometer may be destroyed by flying debris at very high wind speeds.

Fortunately, average winds are light winds. Typically, the wind may blow almost 10 knots during the day and then drop off after sunset, especially on clear nights. As the ground temperature is lowered, a shallow dome of cool, nearly motionless air may form just above the ground. It is to take advantage of these lighter winds that hot-air-balloon festivals are scheduled near sunrise and sunset. After sunrise, surface heating destroys the shallow dome of sluggish cold air, and higher wind speeds result.

Wind speeds are greater at altitudes of 4.5 to 7.5 miles (8–12 km) above the ground. Westerly winds that are 6 miles (10 km) above the ground along the coast of Asia and over eastern North America may exceed 200 knots in winter. These high wind speeds are part of an undulating ribbon of air called the jet stream that circles the globe and controls the weather. Experienced air travelers are well aware that eastbound flights are usually shorter than westbound flights between the same two points because of the tail wind provided by the westerly jet stream. See **JET STREAM**.

### 2. Causes of Winds

Air moves from regions of higher pressure and toward regions of lower pressure. And the greater the difference in air pressure between the high and low regions, the faster the air will move. Air pressure is commonly measured by a barometer. A barometer measures the weight of air in an imaginary column above the instrument. The force (weight) of this air column per unit

area is the air pressure. Changes in air pressure at different locations affect air speed and wind direction.

There are several different forces that move the air and create what is known as the wind. Each of these forces has both a magnitude and a direction. The principal forces include weight, pressure gradient force, friction, the Coriolis force, and centrifugal force.

Weight is the force that always acts downward toward the center of the earth and produces a downward acceleration due to gravity of 32 feet or 9.8 meters per second per second.

The pressure gradient force is the difference in atmospheric pressure between any two locations divided by the distance between them. The vertical part of the pressure gradient force (pressure decreases upward) tends to balance the downward acceleration of gravity. This is called hydrostatic balance. The up-and-down motions of air are gentle, typically several centimeters per second. In intense thunderstorms, however, air may accelerate to up-and-down speeds of tens of meters per second. The strong updrafts and downdrafts in the storms can be very dangerous to aircraft that encounter them.

The horizontal part of the pressure gradient force drives the winds. The stronger the horizontal pressure gradient force, the greater the horizontal acceleration of air from higher toward lower pressure and the stronger the wind. Thus, the greater the pressure differences between any two locations, the greater the wind speed.

Air in motion is affected by friction. Friction results when individual air molecules rub against each other or the ground. The effect of friction is to slow down the wind just as a boat is slowed down by friction with the water. The United States regained the America's Cup from Australia in 1987 in part because the American boat was designed in an unusual way to reduce friction. The slowing action of friction is greater over the rough land than the comparatively smooth sea.

The Coriolis force can be described as the effect produced on a moving body by the earth's rotation. This force acts to deflect winds to the right of their path of motion in the Northern Hemisphere and to the left in the Southern Hemisphere. The location of latitude of the winds and how fast the winds are moving help determine the degree of deflection to the right or left. The Coriolis force varies in magnitude from zero at the equator to a maximum at the poles. The wind speed affects the Coriolis force because the stronger the wind the greater the amount of wind deflection.

Here is one way to picture the effect of the Coriolis force. Suppose a projectile were fired in a straight line path from the North Pole toward a target on the equator. The projectile would land to the right of its true path. This happens because the earth rotates from west to east. Thus the target area would have moved eastward before the projectile reached it.

Try the following experiment to picture the effect of the Coriolis force. Mount an old record on a turntable. Turn on the turntable. Line up a ruler with the center of the spinning turntable and the edge of the record. Scratch the record by drawing a straight line with a knife while the record is spinning. Shut off the record player and look at the record. The scratch will be a curved line. Viewed from above the spinning

turntable you drew a straight line, but viewed from on the spinning turntable you drew a curved line. The difference is entirely a matter of perspective.

Now we are in a position to understand why the winds blow as they do. The horizontal pressure gradient force tends to be largest in winter when the temperature contrasts between land and sea and polar and tropical regions are greatest. As soon as winds move toward lower pressure, however, they will be deflected toward the right in the Northern Hemisphere and left in the Southern Hemisphere, due to the Coriolis force. Eventually a balance is reached between the pressure gradient and Coriolis forces so that the winds tend to blow almost parallel to the isobars, the name given to the imaginary lines on a weather map that connect points of equal barometric pressure. Under these conditions the winds generated by the balance of forces are called geostrophic ("earth-turning") winds.

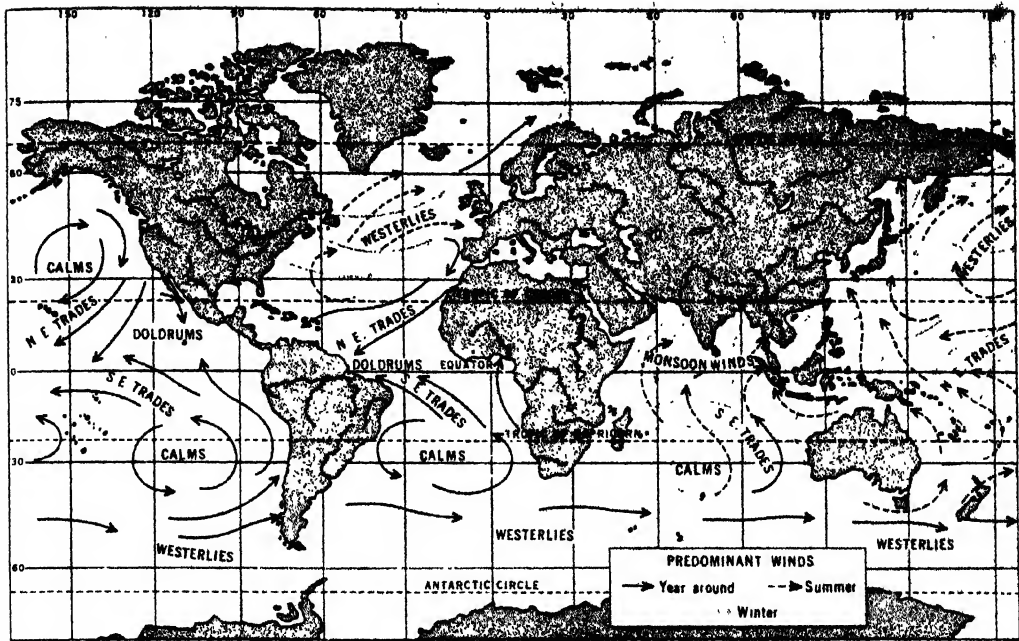
In the atmosphere the geostrophic wind is a fairly good approximation of the true wind. But close to ground level the true wind may only be 30% to 50% of the geostrophic wind because of friction due to various land formations. Over large bodies of water the true wind is 70% to 80% of the geostrophic wind as a result of reduced friction.

The geostrophic wind is a fairly good approximation of the actual wind speed and direction as long as the air flow is not highly curved and friction is not too great. But when the air flow is highly curved, as in cyclonic storms such as a tornado or hurricane, the effect of centrifugal force must be considered.

Centrifugal force can be explained by a simple example. Suppose a person whirls a ball at the end of a string. There is a tendency for the ball, traveling in a curved or circular path, to continually move away from the center of its path and fly off into space in a straight line. If a person whirls the ball too fast, the string may break and this straight outward motion will occur. The outward motion is called centrifugal ("center-fleeing") force. One can feel this outward-moving force when riding on a rapidly turning merry-go-round. The effect of centrifugal force on winds can be seen in rapidly rotating cyclonic storms. In these storms where wind speeds are high, there is a greater tendency of the air particles to continue moving in a straight line. So a balance among pressure gradient, Coriolis, and centrifugal forces must be achieved in order to maintain the cyclonic air flow.

The term used to define air flow balance among pressure gradient, Coriolis, and centrifugal forces is the gradient wind. Around a cyclone or center of low pressure in the Northern Hemisphere, the balance of forces leads to gradient winds that blow counterclockwise. Counterclockwise movement of air occurs because the pressure gradient force is directed inward toward the low pressure center and is balanced by the outward-directed Coriolis force, which deflects winds to the right in the Northern Hemisphere, and the outward-directed centrifugal force. In a cyclone the gradient winds blow at a slower speed than the geostrophic winds.

Around an anticyclone or center of high pressure in the Northern Hemisphere, the balance of forces leads to gradient winds that blow clockwise. Clockwise movement of air occurs because the outward-directed pressure gradient



Major wind systems of the world. Arrows indicate the usual paths taken by these winds.

force and outward-directed centrifugal force are balanced by the inward-directed Coriolis force. In an anticyclone the gradient winds blow at a faster speed than the geostrophic winds.

Since the Coriolis force deflects winds to the left in the Southern Hemisphere, the air flow is reversed in cyclones and anticyclones. In other words, air flow is clockwise around low pressure centers (cyclones) and counterclockwise around high pressure centers (anticyclones) in the Southern Hemisphere.

### 3. Global Winds

Westerly winds (winds flowing from west to east) generally prevail in the 30° to 60° latitude belt of both hemispheres (see figure). Active storms move eastward in these westerly wind belts. The westerly winds tend to be stronger in winter, especially between 40° and 60°N and S of the equator. In reality, the westerly winds are highly variable from day to day. Strong easterly winds (winds flowing from east to west) may occur from time to time near storm systems that are vigorous.

Easterlies tend to prevail between the westerly wind belts and the poles and between the westerly wind belts and the equator. The transition to tropical easterlies (northeast and southeast trade winds) occurs across the horse latitudes near 30°N and S, a zone of little average wind speed and abundant sunshine. The equatorial doldrums is a zone of light winds and occasional thunderstorms where the northeast and southeast trades converge (the Intertropical Convergence Zone).

The term monsoon applies to any seasonal wind. The great Asian landmass exerts a decided monsoonal effect. In winter a huge high-pressure center forms over the continent when the land is cooler than the surrounding water. The clockwise flow of air around the high represents a wind blowing off the continent. The resulting northeasterly flow over India and the

Arabian Sea (northeast winter monsoon) is cool and dry.

During the summer the great Asian monsoon reverses direction as a low-pressure center forms over the heated continent. The resulting southwest monsoon produces abundant precipitation over India, particularly where the moist air-stream is forced to flow over the Western Ghats (mountains) and up against the foothills of the massive Himalayan mountains. The moisture source for the Indian summer monsoon is the Arabian Sea and the Indian Ocean.

Monsoon circulations, although not as dramatic as the Asian flow, are common in many other parts of the world. For example, the summer monsoon in the American state of Arizona corresponds to a period of hot and sultry weather with occasional thunderstorms from mid-July to early September. During this brief period moist air enters the southwestern United States from both the Gulf of California and the Gulf of Mexico.

The ocean responds to the prevailing winds as well. Subtropical high-pressure centers dominate the oceans between the prevailing westerlies and horse latitudes. In the prevailing northerly (southerly) flow of winds along the west coast of North America (South America), cold water from below the surface is brought to the surface by a process called upwelling. The Coriolis force is responsible for upwelling. Where the winds are northerly, the Coriolis force drives the surface water to the west (right). The warmer surface water is replaced by colder water from below. These conditions are good for fishing but bad for swimming. A famous area of upwelling in the Southern Hemisphere is off the coast of Peru in the strong southerly flow. The Coriolis force of the northward moving winds deflects the surface water to the west (left) away from the coast in the Southern Hemisphere. Normally the coastal climate is extremely dry because of the cold water. Every now and then because of



global wind changes (El Niño and the Southern Oscillation), the upwelling ceases as the southerly flow fails. Dramatic warming occurs, the fishing is temporarily ruined, and the arid coastal plain is inundated by heavy flood-producing rains.

#### 4. Local Winds

Winds that affect only small regions are called local winds. Local winds depend upon the time of day and time of year. The position of highs and lows and the strength of the horizontal pressure gradient force also control the local winds. A familiar local wind is the land and sea breeze along the coast. A sea breeze is most likely under clear, sunny skies in the warmer part of the year. Air over the land is heated to a higher temperature than air over the water by day. In response the air pressure becomes a little higher over the relatively cool water. The horizontal pressure gradient force drives an on-shore push of cooler air. The sea breeze may penetrate 6 to 12 miles (10–20 km) inland. Along the coast temperatures may be 5°C to 10°C cooler than further inland. Sea-breeze wind speeds are typically 10 to 20 knots. At night the circulation reverses and a land breeze forms.

Mountain-valley winds are another familiar example of a local wind. After sunrise, the wind will begin moving up the valley and up the adjacent mountain slopes as a valley breeze. Air over the sunlit slopes is strongly heated by the ground. The air ascends rapidly and draws the surface air up the valley. The wind is gentle, usually less than 10 knots. After sunset, the mountain slopes lose heat very rapidly under clear dry conditions. The air in contact with the ground cools rapidly. The cooled air moves down the mountain slopes and down the valley as a mountain breeze. The wind may be briefly gusty with speeds of 10 to 20 knots or more in the early evening.

Mountains are also associated with much stronger and occasionally damaging winds. The katabatic (or cold fall) wind is similar in principal to the nightly downslope mountain breeze. The katabatic wind is far more intense because it is produced from a large mass of cold air over extensive highland regions. The cold air rushes down the side of the mountain as a gravity or density current. A katabatic wind off the Greenland icecap was responsible for the incredible 180-knot wind at Thule, Greenland, mentioned earlier.

Katabatic winds are known by a variety of names around the world. For example, in a *bora* along the Adriatic coast of Yugoslavia wind speeds may reach 100 knots. A similar cold air drainage wind known as the *mistral* can blow down the Rhône Valley in southern France. Because the air is rushing down the sides of a mountain it is dry and skies are typically sparkling blue over the lowlands during a *bora* and a *mistral*.

Warm, dry winds can also blow down from the mountains. The *chinook* ("snow eater") east of the Rockies or the *foehn* wind in the Alps occurs in winter whenever warm air over the mountains is forced to descend. As the descending air is compressed it is further warmed (1°C for every 328 feet, or 100 meters, of descent) and dried. Temperatures east of the mountains may rise 10°C to 20°C or more in a few hours once the westerly *chinook* wind starts to blow at 20 to 40

knots. Snow covers of 4 to 8 inches (10–20 cm) can disappear in a few hours due to a combination of melting and sublimation.

Mountain barriers can also act to channel the wind along them. The Rockies of North America represent a huge block to west-to-east flow. In summer, strong southerly winds east of the Rockies can carry moist air from the Gulf of Mexico northward into Montana and southern Canada, where its presence may lead to severe thunderstorms. In winter, bitter cold Canadian air is funneled rapidly southward east of the mountains on a strong north wind. In Texas and Oklahoma this type of cold north wind is called a *norther*. The *norther* may reach a speed of 40 knots, and it often raises clouds of dust.

On occasion the cold air driven by the north wind crosses the Gulf of Mexico and then rides up and over the Isthmus of Tehuantepec, Mexico, before reaching the Pacific Ocean at very low latitudes as a cold, gusty 20- to 40-knot northerly wind called a *Tehuantepecer*. A similar cold southerly wind east of the Andes in Argentina is called a *pampero*. The Australians use the name *southerly buster* to refer to a dramatic change to cooler conditions along the southeast coast of the continent (air temperatures may drop from 35° or 40°C to 20°C in one hour) as cooler air from the Antarctic Ocean rushes northward at speeds of 20 to 30 knots east of the coastal mountains (Australian Alps and Dividing Range).

Finally, there are winds of the desert. Desert winds tend to be very uncomfortable. They are hot and dry by day and cold and dry by night. Winds of 15 to 25 knots are common, and at these speeds large clouds of dust are raised and carried by the winds.

The *sirocco* is a hot, dry, dust-laden, southerly or southeasterly wind from the Sahara that forms ahead of cyclones moving eastward across North Africa and the southern Mediterranean Sea mainly during the spring. Air temperatures may exceed 40°C or approach 50°C in extreme conditions, in this airstream. A *sirocco* picks up a great deal of moisture and is cooled when it crosses the Mediterranean, and can bring rain and fog conditions to southern Europe. Under sunny conditions, the *sirocco* can produce temperatures in excess of 38°C in southern Europe. Various other names are used to identify the *sirocco* in specific localities. The *leveche* is the name of a local *sirocco* that originates in the Sahara and crosses the Mediterranean into southern Spain. A *khamsein* is the name of a local *sirocco* that originates in Egypt and moves eastward into the countries of the Middle East. This wind remains relatively hot and dry because it does not cross a vast expanse of water.

Two other desert winds of cyclonic origin are the *harmattan* and the *haboob*. A *harmattan* is a northeasterly wind from the Sahara that reaches the west coast of Africa in winter. The name *haboob* refers to very strong desert winds usually associated with dust storms in the African Sudan. These winds also occur in the Sonoran desert of southern Arizona in the United States. A *haboob* wind creates a whirling wall of sand as it picks up sand particles.

All of these and other local winds, however, respond to the global scale distribution of highs and lows and the resulting horizontal pressure gradient force.

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**WINDSOR, Duke of.** See EDWARD VIII.

**WINDSOR**, win'zər, a town in Connecticut, in Hartford county, 6 miles (10 km) north of Hartford. It is situated along the Connecticut River and is bisected by the Farmington River.

Windsor is primarily a residential community. The manufacture of equipment for nuclear reactors is important to the economy. Other industries include insurance services and computer facilities. The raising of tobacco for cigar wrappers was phased out with the invention of a process for making wrappers by forming bits of tobacco into sheets.

The Loomis Chaffee School, a coeducational preparatory school created by the merger of the Loomis (boys) and Chaffee (girls) schools in the mid-1970's, is a leader in its field. The Fyler House, built in 1640, is representative of Windsor's rich history.

A group from Plymouth set up the first English post at the site of the town in 1633. In 1635 colonists from Dorchester, Mass., settled here, and in 1637 the town received its present name. Population: 27,817.

**WINDSOR**, win'zər, a town in central Nova Scotia, on an inlet of Minas Basin, about 37 miles (60 km) northwest of Halifax. The seat of Hants county, it is mainly residential with some light industries and tourism. Settled by Acadians in 1684, the town was called Pisiquid. It was renamed in 1764 after Windsor, England. In the 19th century the town's sawmills, tanneries, furniture factories, foundry, and gypsum mine provided a thriving economy.

The University of King's College (founded in Windsor in 1789), the oldest in Canada, moved its campus to Halifax in the 1920's. Clifton, the home of Thomas C. Haliburton, creator of Sam Slick, is now a museum. Population: 3,626.

**WINDSOR**, win'zər, a city in the province of Ontario in Canada. Canada's southernmost city, it is separated from the United States by the Detroit River and lies south of Detroit. It is located on a peninsula of rich, level farmland surrounded by Lakes Erie and St. Clair and the Detroit River, which joins the two lakes. Jutting deep into the U.S. industrial heartland, Windsor is an international gateway through which millions of visitors pass each year.

The city is connected with the United States by automobile bridge and tunnel, and by railway tunnel and ferry. It is served by five railways, four provincial highways, and the Macdonald-Cartier Freeway, which connects Windsor with Toronto and Montreal. Windsor is also a deep-water port near the midpoint of the St. Lawrence Seaway.

The Art Gallery of Windsor, the Cleary Auditorium and Convention Centre, which is the home of the Windsor Symphony, and the Hiram Walker Historical Museum are located in the downtown area near City Hall Square. The University of Windsor campus lies downstream to the southwest. The city's industrial parks on the eastern and western fringes are connected by an inland crosstown expressway, which passes close to the Windsor Airport. There are miles of recreational parkland along the scenic banks of the Detroit River.

**History.** French settlement of the area began in 1701 with Cadillac's founding of Detroit. Fol-

lowing the American Revolution, the French settlers were joined by English-speaking Loyalists. A ferry connection with Detroit led to the establishment of a hamlet around the ferry dock, which in 1836 the inhabitants named Windsor.

The arrival of the Great Western Railway in 1854 brought incorporation and growth. Other railways followed until the network was completed in 1910 with the opening of a railway tunnel under the river.

Other communities grew up along the river, including the distillery town of Walkerville and the automotive plant town of Ford City. Forming one socioeconomic community with no visible division between them, these towns were collectively referred to as the Border Cities.

Scores of U.S. firms took advantage of favorable tariff policies to establish branch plants in the area. In 1904 the Ford Motor Company of Canada was established, creating the industry that would make the area the "Auto Capital of the British Empire." Propelled by unprecedented prosperity and employment opportunities, the population of the Border Cities passed the 100,000 mark in the 1920's. The work force possessed a high percentage of foreign-born. The opening of the Ambassador Bridge and the Detroit-Windsor Auto Tunnel (1929) signaled the arrival of the automotive age.

With the Great Depression, immigration ceased and unemployment reached 30%. The provincial government intervened to force the amalgamation of the Border Cities into Greater Windsor.

Recovery began with the production of war materials in World War II, and the postwar demand for automobiles brought employment and population gains. By the late 1950's, however, the number of auto workers had dropped to nearly half, industries relocated nearer the center of the Canadian market, and a reputation for labor militancy threatened Windsor's future.

Attempts were begun to diversify the economy and improve the image of the city. Renewal was furthered by the arrival of a new professional class attracted to the city by the opening of the University of Windsor in 1963 and St. Clair College in 1967 and by the growth of the service sector. The newly arrived white-collar professionals altered the labor and blue-collar image of this industrial city. The decades that followed the U.S.-Canadian Autopact agreement and Windsor's annexation of its suburban fringes, both in the 1960's, restored the city's population and industrial growth. Population: 193,111.

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**WINDSOR**, win'zər, a town in eastern Vermont, in Windsor county, on the Connecticut River, 13 miles (21 km) north of Springfield. It is situated at the foot of Mt. Ascutney, a ski area.

Windsor has been called the birthplace of Vermont. Chartered by New Hampshire in 1761, the town was named for John Stuart, earl of Windsor. After Vermont declared itself an independent republic on Jan. 15, 1777, a convention at Windsor adopted a constitution on July 8.

Historic buildings include Constitution House (1772), where the convention met, and Old South Church (1798). Population: 3,714.

**WINDSOR, House of**, the name by which the British royal family is known. On June 20, 1917,

after three years of war with the Central Powers, King George V made the first of two moves designed to show that the royal family shared the emotions of the peoples of the British Empire. He announced that the princes of his family who were British nationals but bore German titles should give up the German titles and assume British names. On July 17, 1917, relinquishing all German titles for himself and his family, the king proclaimed that the royal house would no longer be known as Saxe-Coburg-Gotha or, as they were popularly but incorrectly known, Hanover or Brunswick, but as Windsor.

Between July 16 and 18, 1917, the king created the elder and the younger brothers of his wife, Queen Mary (born a princess of Teck), respectively marquess of Cambridge and earl of Athlone. Similarly, the two Battenberg princes (renamed Mountbatten), one of whom married a granddaughter of Queen Victoria and the other Queen Victoria's youngest daughter Beatrice, were created respectively marquess of Milford Haven and marquess of Carisbrooke.

The British royal family, though of ancient lineage, now bears the newest name among royal families, whether reigning or dethroned. Its previous designation derived from the marriage of Queen Victoria to her cousin Albert of Saxe-Coburg-Gotha. The sovereigns of this house were Edward VII and George V (until 1917). Victoria herself was the last of the Hanoverian line, which had reached the throne in 1714, on the death of the last Stuart sovereign, Queen Anne. The first Hanoverian king was George I, elector of Hannover, descended from the marriage of James I's daughter to the elector palatine.

In renaming the royal house Windsor, neither logic nor sentiment dictated the choice. The only sovereigns born at Windsor were Edward III (1312) and Henry VI (1421), though many have

died there, William IV most recently (1837). Elizabeth II descends from Edward III, but only collaterally, since she does not derive from an heir male of his body. The connotation of the name Windsor was further complicated when, on March 8, 1937, the former Edward VIII, three months after abdicating, was created duke of Windsor, a title that had not hitherto been used for a dukedom, royal or otherwise. At this time the duke was tacitly *persona non grata* in his former kingdom.

On Feb. 8, 1960, it was declared by royal decree that the descendants of Elizabeth II and Prince Philip, duke of Edinburgh, were to be known as Windsor-Mountbatten. The Mountbatten element honors the queen's husband (born Prince Philip of Greece), whose mother was the eldest daughter of Louis of Battenberg, a German prince who became a British subject during World War I, changing his name to Mountbatten and being created marquess of Milford Haven. The same royal decree ruled that the royal house would continue to be known as Windsor.

WALLACE BROCKWAY,

Consultant to the Bollingen Foundation.

**WINDSOR CASTLE**, at Windsor, England, a royal residence of the monarchs of Great Britain, built along a steep ridge above the north bank of the Thames River, 22 miles west of London. It was founded by William the Conqueror, largely rebuilt by Edward III, and further altered by later monarchs. The castle is nearly 1 mile in circumference—the largest in Britain—and the view from the Round Tower embraces portions of 12 counties.

The Round Tower divides the castle into the Lower Ward, to the west, and the Upper Ward, to the east. In the Lower Ward are Albert Memorial Chapel, begun by Henry VII and rebuilt by Victoria, and St. George's Chapel, a magnifi-



Windsor Castle, showing the houses of the Military Knights at left, Henry III's Tower (center), and the Round Tower (far right).

J. Allan Cash, London

cent Perpendicular building begun by Edward IV and completed by Henry VIII. St. George's Chapel is famous for its fan vaulting, for the banners and stalls of the Knights of the Garter, and as the burial place of numerous monarchs and royal personages, including Henry VIII and Jane Seymour, Edward VII and Alexandra, George V and Mary, Charles I, and George VI.

The Upper Ward contains the State Apartments, the monarch's private apartments, the visitors' apartments, and a priceless collection of paintings, drawings, and other art treasures. North and east of the castle is Home Park, comprising about 500 acres. In it is the Royal Mausoleum, where Queen Victoria and Prince Albert are buried. South of the castle is Windsor Great Park (about 1,800 acres), with its fine old trees, traversed by the Long Walk, at the end of which is Snow Hill, commanding a magnificent view of the castle.

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**WINDTHORST**, vīnt'hōrst, Ludwig, German statesman: b. Kaldenhof, near Osnabrück, Hannover, Jan. 17, 1812; d. Berlin, Germany, March 14, 1891. After studying at Göttingen and Heidelberg universities he practiced law at Osnabrück and in 1842 became president of the Roman Catholic board for churches and schools in Hannover.

After the revolution of 1848, he was elected to the Hannover Parliament, becoming president of the lower chamber in 1851 and minister of justice (1851-1853, 1862-1865). After Hannover was annexed by Prussia in 1866, Windthorst was a member of the Prussian Landtag and the German Reichstag. He helped to form the Center Party, consisting largely of Roman Catholics, and was its leader after the death (1874) of Hermann von Mallinckrodt. In this capacity he conducted the fight against Otto von Bismarck's anti-Catholic measures during the Kulturkampf of the 1870's and led the resistance to the Prussianizing of Germany, but later supported many of Bismarck's social and economic programs. Under his leadership, the Center Party became the largest in Germany, remaining so for some 20 years after his death.

**WINDWARD ISLANDS**, wīnd'wārd, island group, Lesser Antilles, between the Atlantic Ocean on the east and the Caribbean Sea on the west, extending from 12° to 15° 40' north latitude and from 60° 48' to 61° 48' west longitude. The Windwards are the southernmost islands of the Lesser Antilles chain, with a total land area of about 1,250 square miles. They consist of five large islands—from north to south, Dominica, Martinique, St. Lucia, St. Vincent, and Grenada—and a group of small islands, the Grenadines, which lie between St. Vincent and Grenada and are divided between them for administrative purposes.

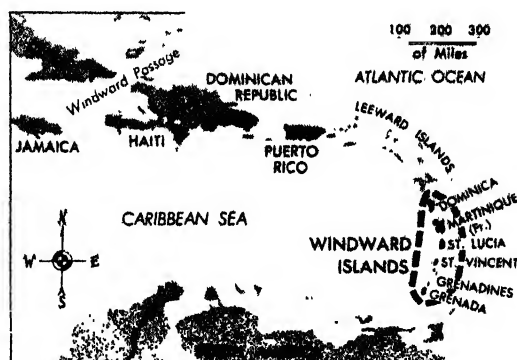
Except for Martinique, an overseas department of the French Republic, the islands belong to the West Indies Associated States of the Commonwealth of Nations. Each of the four large Commonwealth islands is a unit member thereof, with its own Legislative Council, administrator, revenues, and tariffs.

The following account deals only with the British-associated islands in the group; see also separate article MARTINIQUE.

Of volcanic origin, each of the large islands has a mountainous central rib, running from north to south and lying between coastal plains. The dry season (January to May) brings temperatures of 70° to 80° F. During the remainder of the year temperatures rise and humidity increases. Rainfall averages 60 to 70 inches on the coastal plains but rises to as much as 250 inches in the interior. Heavy damage frequently results from the hurricanes that come between the months of June and October.

The economy is agricultural, the principal exports being bananas, cocoa, cotton, spices, arrowroot, copra, and lime juice. There are no railroads, and the terrain hampers road building. Each island has its own airfield and is linked with neighboring islands and the mainland by regular air services.

Dominica was discovered by Christopher Columbus in 1493, and the discovery of the



Location map of the Windward Islands.

others, also by Columbus, came within the next decade. Spain, Great Britain, Holland, and France planted settlements on the islands. Sovereignty over Dominica, St. Vincent, and Grenada was given to Great Britain in 1783 by the Treaty of Versailles. St. Lucia came under British rule in 1814 at the close of the Napoleonic Wars.

The population of the Windwards is mixed, resulting from intermarriage among African slaves, East Indian indentured laborers, Portuguese workers, French and British settlers, and the indigenous Arawaks and Caribs. Pop. (1980 est.) 737,000.

See also WEST INDIES, THE; and separate articles on individual islands.

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**WINDWARD ISLANDS** (Fr. ILES DU VENT), island group, South Pacific, forming the eastern part of the Society Islands, in French Polynesia, an overseas territory of the French Republic. The principal islands are Tahiti and Moorea. Papeete, capital of the territory, is on Tahiti. See also SOCIETY ISLANDS.

**WINDWARD PASSAGE**, ocean channel in the Antilles, between easternmost Cuba and the northwestern prong of Haiti (Hispaniola Island). The strait, approximately 50 miles wide, joins the Caribbean Sea with the Atlantic Ocean, and is on the direct route for ships from the east coast of the United States to the Panama Canal.



FENNO JACOBS/PHOTO RESEARCHERS

Bottled wine is stored and aged in the cellars of Louis Latour, in Beaune, France.

**WINE**, win, the fermented juice of the grape. The word *wine* comes from the Latin *vinum*, akin to Greek *oinos*, which means grape wine and, in a larger sense, the fermented juice of other fruits. The French, who make the greatest wines on earth, in 1905 passed a law that said: "No drink may be kept . . . or sold under the name of *vin* that is not exclusively produced from the fermentation of fresh grapes or the juice of fresh grapes." The emphasis is on "fresh." There had been some earlier trouble when dried grapes (raisins) were imported and used in the making of wine. In Italy, the law of 1925 calls *vino* "the product of the alcoholic fermentation of the juice of grapes, either fresh or slightly dried." The German wine law of 1930 follows the stricter French definition.

Wine drinkers, wine lovers, and wine connoisseurs would hardly agree with such prosaic definitions. Wine, they say, is a living thing, not only to be drunk, but to be enjoyed. King Edward VII of Great Britain once said, "Not only does one drink wine, but one inhales it, one looks at it, one tastes it, one swallows it . . . and one talks about it."

Wine is a product of the earth—*le terroir*, as the French say—and of the sun, but it is also a work of art, for it is made by man and is often a matter of erudite judgment. Of the 5 to 6 billion gallons of wine made each year in the world (about 2 gallons for each human being), much is still made the way Noah made it. But the finest wines are partly the result of technical know-how and great vinicultural improvements. Never before have there been so many good wines on earth. The present is the golden age of wine.

## 1. European Wines

There are many ways of distinguishing and classifying wine. One may speak of dry and sweet wines: of table wines that are drunk with meals, and of fortified wines that are drunk before and afterward. Table wines are either red, white, or rosé (pink). White wines are not water white, but yellowish green, and often are made of black grapes. One can also distinguish still wines and sparkling wines, the greatest of which continue to be produced in the old French province of Champagne, around Epernay and Reims.

**France.**—The greatest wines on earth come from France, where one Frenchman in every seven earns his living making wine. France is blessed with many great wine regions. There is the Champagne country east of Paris, and the territory of the Alsace and Jura wines near the eastern borders. South of Champagne are the vineyards of Burgundy, which go all the way down to Lyon, and farther south begin the vineyards of the Rhône Valley. In the southeastern part of the country are the lesser wine districts of Provence. Southwest of Paris are the wines of the Loire Valley, and below is the greatest wine district of France and the world: Bordeaux. The English, who are among the oldest Bordeaux connoisseurs, call the red wines of Bordeaux clarets.

**Bordeaux.**—There are hundreds of great vineyards in the Bordeaux region, but the best known, and some of the greatest, were singled out by the famous "classification of the great growths" in 1855. Only four were given the supreme accolade of *premiers crus* (growths): Château Lafite, Château Latour, Château Margaux, and Château Haut-Brion. The greatest sweet white wine of Château d'Yquem was called *grand premier cru*. The classification is thought by many people to be outdated and unrealistic. There are *second cru* wines, like Château Mouton-Rothschild, that often fetch higher prices than the *premiers crus*, and there are very great wines in the other districts, especially St.-Émilion and Pomerol, which were not classified at all. Château Cheval-Blanc in St.-Émilion and Château Petrus in Pomerol have made incomparable wines. Altogether Bordeaux produces almost 80 million gallons of wine annually from about 185,000 acres of vineyards, and three quarters of these wines are of *appellation contrôlée* quality, from vineyards whose borders are exactly defined by law. The regions of Médoc, St.-Émilion, and Pomerol produce only red wines; Graves, south of the city of Bordeaux, produces red and white wines, and the districts of Sauternes and Barsac make the finest sweet white wines on earth.

In Bordeaux, "château" means vineyard or estate; the Bordeaux "châteaux" have nothing in common with the châteaux of the Loire country. In addition to the four *premiers crus*, Médoc produces 15 second, 14 third, 11 fourth, and 18 fifth *crus*, but this is not always a scale of quality, for there are no inferior wines in Médoc; some are just better than others. After the classification of 1855, hundreds of other vineyards were classified into "bourgeois," "artisan," and "peasant" growths, and the "bourgeois" growths were divided into two parts.

The great clarets have inspired poets and experts for centuries. Bordeaux are the "queens" of wines, because they are more delicate and



feminine than the heavier-bodied, masculine Burgundies, which lack the extreme finesse of the great clarets but make up for that by their bouquet.

**Burgundy.**—Wine making began in Burgundy 2,500 years ago, and ever since the Burgundians have declared the superiority of their great wines. The greatest of the red ones are Romanée-Conti, Clos de Vougeot, and Chambertin, said to be the favorite wine of Napoleon I. There has never been enough Burgundy for all who want it, and as a result there has been a lot of blending and "stretching." It is harder to buy a first-rate Burgundy than a first-rate Bordeaux, for which the sentence "*Mis en bouteilles au Château*" is always a sign of guaranteed quality. Burgundy labels sometimes but not always carry the wording "*Mis en bouteilles par le propriétaire*" or "*Mis au Domaine*."

The greatest red and white wines of Burgundy come from the Côte d'Or, a ridge south-southwest of Dijon. The northern part of this ridge, called Côte de Nuits, produces three quarters of the great red wines, the southern part, the Côte de Beaune, makes some reds and the great white wines. Greatest of the white wines are those of Montrachet, whose 19 acres produce less than 1,000 cases in a good year. The proprietors keep about 250 cases and sell about 250 to friends, so that less than 500 cases are available for sale and it is very hard to find an authentic Montrachet. In the northern part of Burgundy are the famous vineyards of Chablis, the best of the Chablis Grand Cru are very fine. South of the Côte d'Or are the Chalonais, Mâconnais, and Beaujolais wines. The Beaujolais is one of the most popular red wines on earth, it should be drunk when young. The best Beaujolais comes from Juliénas, Moulin-à-Vent, Fleurie, Chénas, and Morgon.

**Other Districts.**—The wines of the Rhône Valley, from Vienne to Avignon, are sun drenched red, and sturdy: Côte Rôtie, Hermitage, Châteauneuf-du-Pape. A good white Rhône wine is the Condrieu. There are charming dry white wines in the Loire district (Pouilly-Fumé, Sancerre, Vouvray), and pink and white ones in Anjou. There are well-known white wines from the vineyards of Alsace on the left bank of the Rhine, but not quite so good as the German Rhine wines. The best are the Rieslings, followed by the Gewurz-Traminer. There are lesser wines from the Jura, Savoy, the Pyrenees, and Provence.

**Germany.**—Among the world's wine-producing countries Germany ranks far down in quantity, but the best German wines come close to the top French ones. The greatest German wines are the greatest of all, in the opinion of hock connoisseurs. They are made with painstaking care by people dedicated to their art; the finest of them are more expensive than the best French wines. The great Rheingau wines, from the north bank of the Rhine between Rüdesheim and the neighborhood of Mainz, include the celebrated Johannisberger Kabinett. They are made from overripe grapes (*Beerenauslese*), selected grapes from selected bunches (*Trockenbeerenauslese*), and late pickings (*Spätlese*).

The wines of Rheinhessen, south of the Rhine and southwest of Mainz, are not quite so good as those of the Rheingau—milder, softer, lighter in taste. The wines of the Palatinate (Rheinpfalz) have neither the delicacy nor the long life of the most famous Rhine wines. But the great

Moselle (Mosel) wines are a different story. They mature quickly, are best drunk when they are about 4 years old (Rhine wines may be 10 times as old), and the best have a luscious, magnificent bouquet; the great Bernkasteler, Piesporter, or Wehlener wines are among the world's greatest.

**Spain and Portugal.**—The vineyards of Spain, blessed by sunshine year after year, produce almost 500 million gallons of table wines annually, 17 gallons per person, and many of them are quite good. The country produces one great wine, sherry from Jerez de la Frontera, just up the coast from Gibraltar. Sherry is "fortified" (extra alcohol is added) and "blended" (heavy wines are balanced with light ones, acid with delicate ones). The most popular fortified wine, it has been called "unique" and "inimitable" by the British, and is mostly an Anglo-Saxon drink, more sherry is bottled in London, Liverpool, and Bristol than in Spain. The finest sherries are called Finos (pale and dry), Amontillados (not quite so dry), Olorosos (rather sweet, rather dark), and Amorosos (paler and sweeter than Olorosos). Sherry is a magnificent wine for cooking.

Portugal is famous for port, most of which goes to England. In England "port" means wine made in a closely specified area of the upper Douro Valley in northern Portugal. Vintage port is dark ruby, with an intense, fruity taste, the product of a single year. English connoisseurs drink vintage port "only when it is at least twenty years old." Blended port, "Port from the Wood," is a blend of ruby and tawny ports, less expensive and less outstanding in quality than vintage port.

The best wines from the Madeira Islands can live for a century. In London, with some luck, one can still purchase the vintages of 1789 and 1795. The best vineyards are near Funchal, the capital. Good Madeira has a caramel-like flavor and will keep its freshness only for a short time after the bottle is opened.

**Italy.**—Italy produces over a billion gallons of wine each year. Most of the wines are good ones, but few are great. Italian wines that are exported are *vinii tipici*, wines "true to type," full and hearty. Everybody in Italy drinks these wines; nobody bothers about vintages. The finest Italian wines come from the Piedmont in the north, resembling somewhat the Rhône wines. The best known are the red Barbaresco, Barbera, and Barolo, and the white Asti Spumante, Caluso, and Cortese. The best known of all Italian wines is Chianti from Tuscany. The best Chiantis are always shipped in bottles (not in straw-covered *fiaschi*) and, if they are genuine, can be very good. Lombardy and Liguria make the red Grumello, Inferno, and Sassella, and the white Cinque Terre. South Tyrol makes a pleasant rosé, Santa Maddalena, and Merano's light, lovely Küchelberger (di Collina). From Lago di Garda come red Bardolino and Valpolicella; from Terzano, a fine white wine by the same name. Emilia-Romagna produces vast quantities of undistinguished Lambrusco and Albana, and there are the dry or fruity Orvieto and the Frascati which Horace praised because he did not know better. Italian wines are meant to be drunk and enjoyed casually, without sipping, tasting, or fussing.

**Choice and Use of Wines.**—One man's wine is another man's poison. A man should drink the

wine he likes best. It takes a long time to learn about wines; real knowledge comes only after years of intelligent tasting and drinking. It is easy to distinguish a poor wine from a great one, but very, very difficult to distinguish two great ones and even more difficult to describe the difference. The French always drink wine with their food; the Germans often leave their finest bottle until after dinner. Most Frenchmen drink wine every day of their adult lives, but it is rarely a great wine, and often only an ordinary *pinard*. There are no hard and fast rules as to which wine should be drunk with what, but there are a few truisms that have been born out of experience.

Dry white wines go best with *hors d'oeuvres*, fish, shellfish, and oysters: Chablis, Pouilly-Fuissé, Puligny-Montrachet, Chassagne-Montrachet, Sancerre-Sauvignon, Vouvray *sec*, Graves *sec*, Tavel, Hermitage *blanc*, Montrachet, Alsace, most hocks, and all Moselles.

With white meat and fowl, serve red Bordeaux from the Médoc or Graves regions, Beaujolais and light red Burgundies; or Chinon, Arbois, Bourgeuil. With red meat, game, *foie gras*, and cheese, serve Pomerol, St.-Émilion, Néac; Beaune, Pommard, Volnay, Corton, Nuits-St.-Georges, Clos Vougeot, Musigny, Romanée, Chambertin; Moulin-à-Vent, Morgon, Julienas; Hermitage *rouge*, Côte Rôtie, Châteauneuf-du-Pape. Some people are addicted to sweet wines, but they should be served only with dessert and fruit: Anjou, Monbazillac, Sauternes, and some Rhine and Alsatian wines.

The first rule in wines, however, is that there is no disputing tastes. The proprietor of Château d'Yquem, the greatest sweet white wine on earth, drinks his wine even with fish (and likes it). There is an old dictum that *brut* champagne can be drunk with everything from *hors d'oeuvre* to dessert, but there are people who cannot (and must not) drink champagne. One good rule is never to follow a fine wine with a poor one, or a heavy wine with a light one. The French gourmet Anthelme Brillat-Savarin (1755-1826) said, "The order of food in a dinner is from the more substantial to the lighter, for the appetite is appeased in eating." With the accompanying wines, it is the other way around: they begin with the lighter ones and gain in intensity, body, and age.

The vintage myth is, like all myths, based on sound facts. Wine is sunshine caught in the grape. When the weather is sunny, there will be more sunshine in the grapes and more sugar; and it is the sugar in the grape that ferments to form alcohol. In some years, like 1945, there is good weather everywhere, and great wines are made in many vineyards all over Europe. The 20th century's great vintage years in red Bordeaux were 1953, 1952, 1947, 1945, 1934, 1929, 1928, 1924, 1904, and 1900.

**Purchase, Care, and Serving.**—Buying wines is difficult and beset with traps. It is easy to buy a great bottle of Château Cheval-Blanc (because it is château bottled), but it will be costly. The value of wine is always relative. If a bottle of wine is bad, even a low price is too much.

One of the secrets of enjoying wines is to have an honest, reliable wine merchant. Much wine is exported in barrels and bottled in other countries, and sometimes strange things happen. Delicate, low-alcohol wines travel less well than

others. The ocean voyage adds a year or two to the age of the wine. The trick is to buy wines when they are young and relatively inexpensive, and store them until they are ready to be drunk.

More wines are ruined by being drunk too late than too early. The 1944 clarets were ready to be drunk 10 years later, when many of the 1937 reds, because of their great amount of tannin, were not yet ready to be opened. Half bottles are all right for trying out an ordinary wine, but great wines suffer from being in half bottles. They are better in a magnum (double bottle) than in the ordinary bottle.

Wine bottles must be stored lying down so that the bubble of air within the bottle is clear of cork. If the cork dries out, air will carry acetobacter and other organisms into the bottle and ruin the wine. It makes no difference whether the "cellar" is a large room with indirect lighting or a small wooden box, if only a couple of bottles are kept in it. But it should be free from vibrations and rather cool. The ideal temperature is between 50° and 55° F. Dampness should be avoided; darkness is best.

Red wines often cast a deposit, and care should be taken to bring the bottle from the cellar to the table without disturbing the sediment. The neck of the bottle should be wiped clean and the cork removed, so that no bits of cork drop into the wine. The wine should be served at proper temperature: white wines should be cooled slowly and gradually (chilled but not frozen); red wines should be brought up in time, opened, and allowed to warm gradually to room temperature. They must never be placed near a hot stove, or the wine will "break." Champagne is usually served quite cool. It is the great wine for festive occasions.

Fine red wines of old age should stand upright for several hours before they are decanted or served, to give the sediments time to settle back to the bottom. Improper handling can ruin the finest wine. Many people prefer to decant old wines, pouring carefully, with a light behind the bottle, so that they see when the sediment comes out and they must stop. Old wines should be opened at least half an hour before they are served; the wine wants to breathe. It is absolutely unnecessary to use baskets. The glasses should be large; great wines are easily ruined by small glasses. Glasses should be tulip shaped, clear, and thin, without markings or etchings. They should be less than half filled to permit the full enjoyment of the color, bouquet, and taste of a fine wine.

Sherries should be drunk when they are freshly bottled; on the other hand, a sturdy sherry will remain good in the bottle for weeks after it is opened. Everyone seems to agree that sherry is the only wine that may be drunk while one smokes; some say that tobacco actually enhances the taste of the wine. It should be served in a "sherry sampler's" glass, never more than two thirds filled. A dry sherry is a classic aperitif. A vintage port is a fine way of concluding a great meal. The greatest vintage port still available is 1896. Other great years were 1900, 1904, 1908, 1912, 1917, 1927, 1931, 1934, 1935, 1947. As to Madeira, it lasts longer than any other wine; a great Madeira never comes of age. It is good to serve with dessert.

See also separate articles on individual wines.  
JOSEPH WECHSBERG.

## 2. American Wines

California and New York are the leading wine producers in the United States. Wine is also made in some of the midwestern and Middle Atlantic states. The United States produces both red and white wines, rosés, fortified wines, such as Port and Muscatel, sparkling wines and champagne, native fruit wines, and "pop" wines. The table wines contain 11% to 14% alcohol, while the wines fortified with brandy may contain from 17% to 20%. They are taxed according to their alcoholic content.

American wines are unique and different, but considered by some authorities to be as fine as the wines of Europe and France. It is difficult to distinguish between an American Chardonnay and French White Burgundy. In blind taste-testing by experts, many of the American wines have proved equal, or superior, to their famous European counterparts.

Labeling, not quality, is largely to blame for the slow acceptance of American wines. The standards for labeling wines in America are not the same as those for labeling in France. Therefore two bottles of wine with the same *generic* label may be two completely different types of wines that cannot be compared. Most of the American wines are *varietals*, and the *generic* French names indicating the district where the wine is made in France, are not applicable to American wines, and yet some of the names have been carried over.

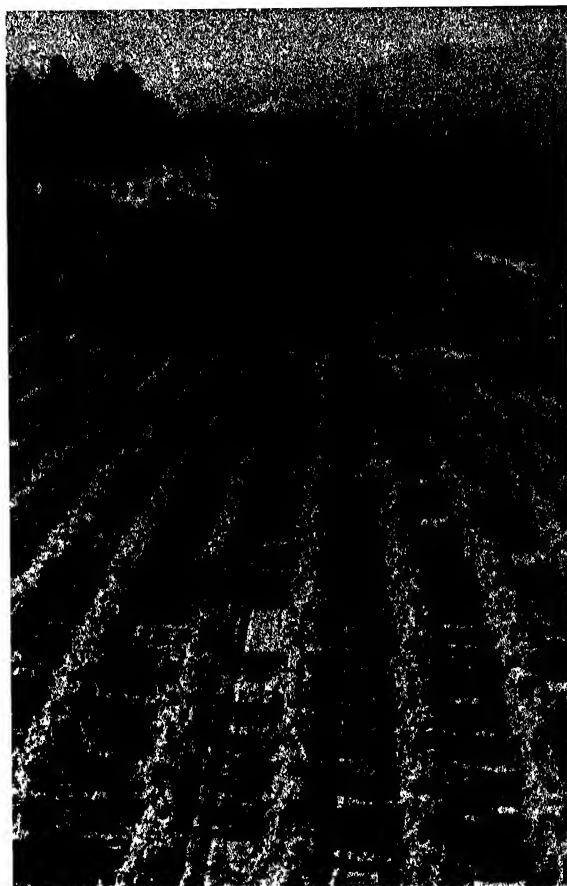
The trend in the industry now is to pull away from the *generic* names, so that the American wines will no longer be compared with the European wines bearing the same name, but unrelated in quality. The *varietal* identification on the label of an American wine bottle means that the contents were made from at least 51% of that particular grape. The wine may also contain a blend of other grapes to enhance its color, its aroma, or its flavor.

The finest white wine in America is Chardonnay. It compares with the aristocratic French Chablis. American Chablis, on the other hand, is a white table wine made from a blend of white grapes, but does not contain the expensive, hard-to-grow Chardonnay, so it is in no way the equivalent of French Chablis, nor does it pretend to be. The wineries are gradually changing the identification of American Chablis to "White Table Wine" to avoid this confusion.

The finest red wines in America are made from either Cabernet Sauvignon or Pinot Noir. These wines compare with or surpass the red Burgundy of France which is also made from the Pinot Noir grapes. American Burgundy is an inexpensive blended red table wine, in no way related to the French Burgundy. As in the case of Chablis, American wineries are changing the labels to read simply "Red Wine."

Perhaps the greatest controversy with the European market comes from the sparkling wines made in the United States under the label of "champagne." French vintners are anxious to initiate international controls that would eliminate the confusion that exists in labeling, but such controls would give that country a monopoly over the production of champagne.

A number of American champagnes are made by the traditional French *méthode champenoise*, which requires that the second fermentation



COURTESY OF CHRISTIAN BROTHERS

The Napa Valley of California is blessed with a mild climate that is ideal for growing wine grapes.

(which produces the bubbles) take place in the bottle. The inverted bottles must then be hand-turned over a period of many months. The yeast sediment that collects in the necks of the bottles is disgorged in a bottle-by-bottle process. A more modern process empties all the bottles mechanically after the second fermentation so that the entire batch may be filtered and rebottled.

A second, less-expensive process is employed by many wineries in America for the making of champagne. This is known as the "Charmat" or "Bulk Process," in which the second fermentation takes place in bulk rather than in the bottle. It is quite acceptable for beverages made by either process to be called "champagne" in America, but those produced by the Charmat method must so indicate on the label. In France only sparkling wines made by the traditional method in the Champagne district (where the Charmat process is forbidden) may be called, and sold as, "champagne." Anything else must be labeled "sparkling wine."

Other labeling misconceptions include the Fumé Blanc or Napa Fumé, a name taken from the Sauvignon Blanc of the Loire Valley, which acquires smoky characteristics as it ripens. American winemaker Robert Mondavi liked the sound of the French word *fume* (meaning smoke), so he used it to name a delightful, very dry, American white wine that has no connection with the French Sauvignon Blanc. Also, Chianti, which is a fine wine in Italy, is a popular, ordinary wine in a fancy bottle under its American label. An-

other example is Grey Riesling which is not related to the German Riesling grape whatsoever.

**California.** The California wines more closely resemble the wines of Europe because they are made from the *V. vinifera* brought to this country from France. In many instances, however, the bouquet is enhanced by a blend of native grapes as well, giving it a special unique quality that is American. Some of the finest wines in the country, including the Chardonnay and Cabernet Sauvignon, come from the Napa Valley. Other wine producing districts in California include the San Joaquin Valley, Lodi, Sacramento, Santa Clara, Alameda, Contra Costa, and Solano. The ideal variables of the California climate make it easier to grow *Vinifera* in that state than in any other part of the world.

One of the state's most distinctive wines, however, is made from native grapes called Zinfandel. The wine from these grapes may be made in several different ways, varying from a fresh young wine to a late-harvest wine with a complexity of flavors and a 15 to 17 percent alcohol content.

**New York.** The Finger Lakes district of New York is the largest wine-producing area in the United States outside of California. The Grape Belt extends from Lake Erie southwestward to the Pennsylvania border in a narrow strip that varies from three to sixteen miles wide. The grapes grown here and in other wine-producing sections of the East are mainly *V. labrusca*, particularly Concord, which produce a "foxy" or fruity taste. A wine carrying the New York state label may contain up to 25% of the juice of grapes from other states, which enables the wineries to develop a blend that lowers the "grape jelly" flavor of the Concord grape wine. Other native grapes used in New York state wines made with native grapes, and so labeled, are Delaware, Moore's Diamond, Niagara, Dutchess, Missouri Riesling, Vergennes, Isabella, and Catawba, all of which have a predominant *labrusca* taste.

In recent years the development of French-American hybrids such as De Chaunac and Seyval Blanc has become an exciting innovation in the wine-making industry. The results are native hardiness and resistance to disease combined with the delicate flavor of the French *V. vinifera*. These hybrids have made it possible to begin the production of *Vinifera* in sections of the country where they previously would not grow.

New York state is also prominent in the production of "pop" wines. These carbonated wines with 8% alcohol content are a teenage transitional beverage between soft drinks and wines. They may be cherry, peach, apple, or grape flavored and have names like Strawberry Hill, Apricot Splash, and Tickle Pink.

**Midwest.** Ohio and Michigan are the leading wine-producing states in the Midwest. At one time Cincinnati was the heart of the Ohio wine country, but its Catawba vines were destroyed by disease and were never fully restored. The vineyards of Ohio are now found along the shores of Lake Erie from Sandusky to the Pennsylvania border.

Paw Paw is the center of the Michigan wine country where most of the grapes grown are native Concord. Michigan's chief contribution to the wine-drinking world is Cold Duck, which

began in Detroit as a bar drink. Cold Duck, a sparkling wine that was popular in the 1960's, gets its name from Germany where partygoers at the end of the evening would pour the remains from their bottles into one container, and, in a pun on the words *kalde ende*, meaning "cold end" or "leftover," call it *kalde ente* or "cold duck." Cold Duck is literally that, a combination of sweet sparkling red and white wines.

Vineyards were first planted in Missouri in Hermann in 1843, and winemaking is still conducted in the Ozark Mountains of both Missouri and Arkansas.

Midwestern states are also known for their fruit wines. Wisconsin makes a cherry wine, and Michigan produces strawberry, peach, and apple wines. Rhubarb wine is made in Iowa. Most of these are served as cordials or as a dessert over fresh fruit.

**Middle Atlantic States.** Most of the *Vinifera* planted in the Middle Atlantic states did not survive, so the wines made here now are from native grapes, such as *Labrusca* in Virginia and Catawba in Maryland. New Jersey makes great quantities of all kinds of wines, both still and sparkling, and Scuppernong may still be found in limited quantities in the southern coastal states.

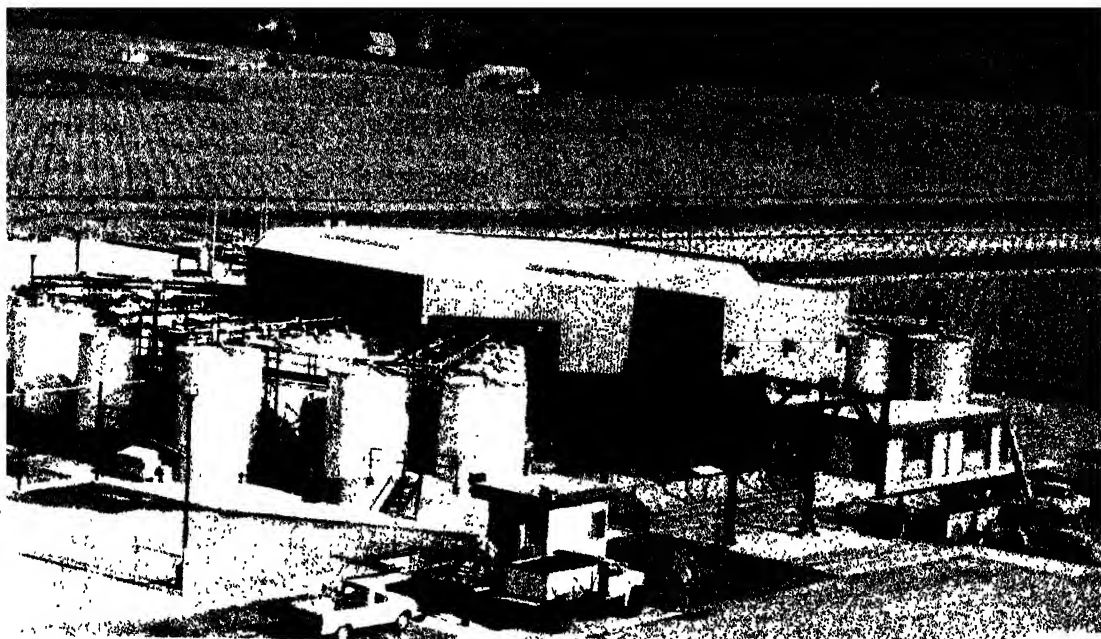
**Choice and Use.** As the wine industry comes of age in America, the wines that are made there are being recognized as American, and generic names which have been inappropriately applied in the past, are falling into disuse. The wines instead are identified by their *varietal* names, and should not be ordered by names corresponding to the European generic labels. Chardonnay is equivalent to French Chablis, but American Chablis is a white table wine. French Burgundy is equaled in America by Cabernet Sauvignon or Pinot Noir, but American Burgundy is a blended red table wine. Since American wines do not imitate the winemaking district in France for which they were originally named, they should be selected on their individual basis, as they are uniquely American.

American white wines such as cocktail sherry, Chardonnay, Seyval Blanc, and Pinot Blanc are served with appetizers. Red wines including Baco Noir, Barbera, Petite Sirah, Cabernet Sauvignon, Pinot Noir, Foch, Chancellor, and Zinfandel are appropriate with a variety of cheeses, including cheddar. Cold buffet foods are accompanied by dry rosé, Gamay, Gamay Noir, or Pinot Noir.

White wines to accompany fish and seafood include Emerald Riesling, White Riesling, Seyval Blanc, Gamay, Chardonnay, Chenin Blanc, dry Sauvignon Blanc, or Rosé of Pinot Noir. Red wines served with meat or game include Cabernet Sauvignon, Pinot Noir, Petite Sirah, Chancellor, Chelois, Ruby Cabernet, Zinfandel, Baco Noir, and Barbera.

American white wines that are served with pork, ham, chicken, and turkey include Chenin Blanc, Gamay, Gamay Beaujolais, Sauvignon Blanc, Pinot Blanc, Vidal Blanc, Seyval Blanc, White Riesling, Emerald Riesling, and Delaware. Sweet or semi-sweet dessert wines include Aurora, Catawba, sweet Chinen Blanc, and Malvasia Bianca. Gewürztraminer goes with spicy foods, sausages, Virginia-style ham, and seafoods or fish in rich or seasoned sauces.

HELEN POWERS



This modern crushing and fermenting plant in California makes it possible for the winery to ferment a great variety of wine grapes with exact control of factors such as the temperature and the duration of fermentation.

### 3. Production

Most of the wines of the world are the product of the alcoholic fermentation of grapes. Some wines, however, are made from other fruits or from berries and are designated by the name of the fruit; for example, peach wine and blackberry wine.

**Raw Material.**—The composition of the grapes has a very important influence on the composition and quality of the fermented wine. Varieties of *V. vinifera* normally attain about 18 to 24 percent of sugar in the temperate zones. This is sufficient to produce a stable wine of about 10 to 13 percent alcohol (by volume) after fermentation. However, in the more northern areas of the temperate zone (for example, Burgundy in France and on the Rhine in Germany), *V. vinifera* does not ripen sufficiently to produce even 18 percent sugar, and in order to make a stable wine it is necessary to add sugar to the grape juice (must) before fermentation. Also, in the eastern United States, the native varieties and hybrids used usually do not attain sufficient sugar to make a balanced wine, and addition of sugar is common. In Europe, where the climate varies rather markedly from year to year, no sugar may be added to the grapes produced in very warm years, while in very cool years a considerable amount of sugar must be added. Obviously, wines produced without addition of sugar are of higher quality. This is one of the reasons why the wines of northern Europe differ in quality from year to year. Another reason is that the acidity also varies, depending on climatic conditions; in the cooler years more acidity is retained than in warm years. Therefore, even though there may be sufficient sugar for a balanced wine, the variations in acidity will cause the wines of the warm years to be different from those of the cooler years. There are also poorly defined differences in the aroma constituents in grapes between the warm and cool seasons.

The vineyardist must watch carefully the ripening process of the grapes so that they can be harvested at their optimum maturity—if they

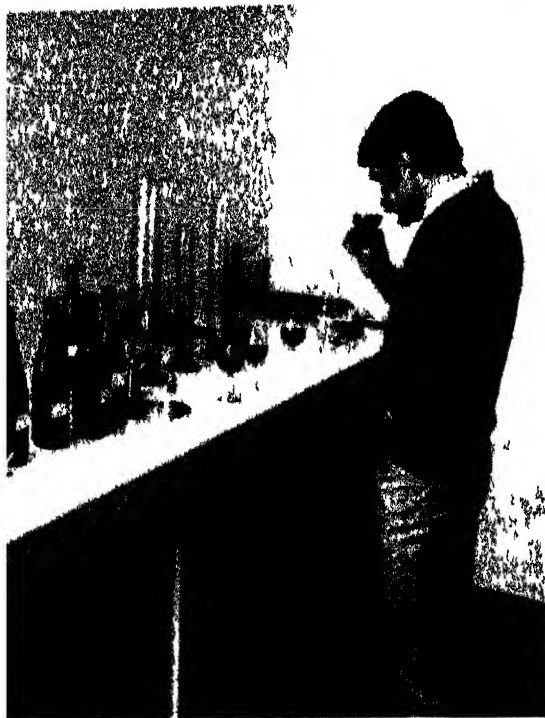
can reach optimum maturity under the climatic conditions of the season and region. For this purpose small but representative samples are taken from the vineyard regularly during the ripening period. The vineyardist carefully observes the increase in sugar and the decreases in acidity that occur during ripening in order to start harvesting at the most favorable balance of the two. The traditional vintage *bans* (fixing the day for vintage to begin) of Europe were a sort of collective control to ensure harvesting at the proper stage of maturation.

One limiting factor on how long the grapes can be left on the vines is the possibility that the grapes may rot after fall rains when the humidity rises. Also, in some cases the leaves will fall off, and no further increases in sugar can be expected. When the proper time for the vintage is reached, the grapes are harvested by cutting them from the vines with shears or with knives, placing them in baskets or boxes, and transporting these to the winery.

**Fermentation.**—It is necessary to crush the grapes in order to release the juice from the pulpy material. This is done by roller crushers or, more commonly now, by rotary paddle crushers. The crushed grapes are then pumped to the fermenting room, if red wines are to be made, or to juice separators or presses if white wines are to be made. Ordinarily, white grapes are used to produce white wines, but most red grapes can be used to produce white wines if the juice is rapidly separated from the skins.

**Red Table Wines.**—The production of red table wines involves placing the grapes in an open fermenting tank, adding about 75 parts per million of sulphur dioxide, a mild antiseptic, and after the antiseptic has had a chance to work, adding a small inoculum of a culture of pure yeast. The purpose of the antiseptic is to kill or inhibit wild alcohol-intolerant yeasts, primarily *Kloeckera* species, *Pichia* species, and *Hansenula* species. The purpose of adding an active culture of pure yeasts is to provide an inoculum of alcohol-tolerant yeasts. The primary yeasts responsible for alcoholic fermentation are varieties





TULANE/PHOTO RESEARCHERS

Quality control of good wines requires the services of wine tasters with acute senses of taste and smell.

of *Saccharomyces cerevisiae* var. *ellipsoideus*, often called the true wine yeast.

During fermentation the sugars of the grapes are converted to alcohol and carbon dioxide. Heat and several byproducts are also produced. In many regions the grapes are in such good condition and contain such an adequate microflora of their own yeasts that neither antiseptics nor yeast cultures are required. However, the variety of yeast has only a minor effect on the specific quality of the wine. The variety of grape is the primary factor controlling the overall quality of wines. Fermentation begins almost at once after the yeasts are added.

The flavor and coloring materials are located in the skins, and as the alcohol is produced from the fermentation of sugar, the flavors and colors are extracted from the skins. The fermentations on the skins last from three days to as much as two weeks, depending on how much tannin it is desired to extract from the skins. Wines that are intended for long aging generally are fermented on the skins longer than those that are expected to reach maturity earlier. During fermentation the floating layer of skins (called the cap) must be pressed down into the fermenting juice once or twice daily. Alternately, the juice may be pumped out of the bottom of the tank and sprayed on the cap. In warm weather sufficient heat may be retained to cause the temperature to rise so high as to inhibit yeast growth; cooling is necessary in such cases. After the desired amount of color and tannin has been extracted, the solid material (skins and seeds) is separated from the partially fermented juice in a press. Both basket-type and continuous-screw-type presses are used for this purpose, the former giving the best results.

**White Table Wines and Rosés.**—In the production of white table wines, the crushed grapes are immediately separated from their skins by placing them in a juice extractor, by draining off the juice in a settling tank, by pressing, or by combinations of these. Both hydraulically operated basket presses and cylindrical presses are used for this purpose; continuous presses are not suitable for unfermented crushed grapes. The unfermented juice is often settled by putting it in a cool place with about 100 parts per million of sulphur dioxide for 12 to 24 hours. This settling process allows the solid material (pieces of skins and seeds) which has pressed through the juice extractor or press to settle out, and the clear supernatant liquid is then decanted off for use in the actual wine-making process. This settling process produces lighter-colored and earlier-maturing wines. The juice, settled or not settled, must be inoculated with a pure yeast culture in most cases; about 1 to 3 percent of an actively fermenting pure yeast culture is usually used. The white wines are best fermented at relatively low temperatures, where they retain more of their fresh fruity flavor, temperatures of 50° to 60° F. being recommended.

In most cases, it is desired to ferment out all of the sugar in the production of white table wines. However, in a few cases white table wines with residual sugar are desired. This is particularly true in regions where the grapes have attained a high degree of sugar owing to attack of the mold *Botrytis cinerea*; for example, the Sauternes region of France. In these cases, the fermentations must be conducted at low temperatures in order to control the rate of fermentation. When the fermentations reach the desired sugar percentage, the wine is racked off the yeast sediment and cooled to about 50° F. or lower, and sulphur dioxide is used to reduce further the rate of fermentation. Filtration may also be employed to separate the yeast from the wine and thus stop fermentation. Recently fermentation under pressure has been used to control the rate and extent of fermentation.

An intermediate type of wine between white and red table wines are the pinks, or rosés. These are produced either by fermenting varieties of grapes with a small amount of color in the skins, as for red table wines, or by using normally colored varieties and separating the juice from the skins within 12 to 36 hours after the beginning of fermentation.

**Fortified Wines.**—Another type of wine, particularly popular in the United States, is fortified wine. These are wines to which alcohol is

#### LEADING WINE-PRODUCING COUNTRIES

Country	Thousands of hectoliters	Millions of gallons
France	71,813	1,897
Italy	65,850	1,740
Soviet Union	31,500	832
Argentina	26,500	700
Spain	24,749	654
United States	14,992	396
Romania	8,964	237
Portugal	8,130	215
West Germany	7,966	210
Yugoslavia	6,380	168
South Africa	6,300	166
Bulgaria	5,116	135
Algeria	5,000	130
Chile	5,000	130

Source: U. N. Food and Agriculture Organization, 1976.

added during or after the fermentation. The source of the alcohol is high-proof spirits obtained from the distillation of wines. The purpose of the addition of the alcohol is to stop the fermentation. Whether added during or after fermentation, the alcohol is raised to about 18 to 20 percent. Wine types such as port and muscatel are produced by fortifying during the fermentation; they retain 10 to 15 percent sugar. Dry fortified wines such as dry sherry and dry madeira are produced by adding the alcohol after the fermentation.

**Vermouth.**—Another type of dessert wine is vermouth. Two types of vermouth are produced at the present time: dry vermouth (French type), which uses a dry fortified white-wine base, and sweet vermouth (Italian type), which uses a sweet fortified white-wine base to which caramel syrup is added for coloring. Cane sugar is sometimes added for sweetening. In either case, mixtures of herbs or herb extracts are added to the wine base to impart the requisite herbal character. More than 60 different herbs have been used for vermouth production; among these are angelica root, anise seeds, bitter orange peel, cinchona bark, cloves, coriander seed, gentian root, quassia wood, Roman and common wormwood, and vanilla beans.

**Sparkling Wines.**—Sparkling wines contain an excess amount of carbon dioxide. The most popular types are champagne and other white sparkling wines, although some pink and red sparkling wines are also produced. The basic material for producing sparkling wines is a fruity, very clean-smelling white, pink, or red table wine of about 11 to 12 percent alcohol. To this basic material (called the *cuvée*) sugar and yeast, in carefully controlled amounts, are added. The mixture is then placed in a closed container for the secondary fermentation, which produces carbon dioxide and alcohol. Since the wine is in a closed container, it acquires a pressure of carbon dioxide gas.

Two general types of closed containers are used. The traditional method is to ferment in the bottles. Special bottles are used, which will not burst under the pressure; the cork is also held in with a special metal clamp. After the fermentation is completed, the bottles will contain about six atmospheres of pressure. In order to acquire the maximum quality, the wine is aged on the yeast for one to three years. When the wine is ready to market, it is necessary to remove the yeast deposit from the bottles with a minimum loss of pressure. This is done by turning the bottles on end and allowing the yeast sediment to drop onto the corks. The pressure in the bottles is then reduced as much as possible by lowering the temperature to about 25° F. and freezing the neck of the bottle. The yeast deposit is disgorged by carefully removing the cork and allowing the frozen plug of yeast and wine to be forced out. More wine and a small amount of brandy-sugar solution is added to fill the bottle, and a new cork is quickly inserted. Bottle-fermented sparkling wines are sometimes disgorged into tanks and the wine filtered into the bottle.

The other and more modern process is to ferment the wine in a closed tank—usually with capacity of 500 to 1,000 gallons and made of stainless steel. After the fermentation is completed, the requisite brandy-sugar solution is added, and the whole mixture is passed through



COURTESY OF THE WINE INSTITUTE

In many wineries traditional huge wooden vats are still used for fermentation of the crushed grapes.

a filter into the bottles. This is obviously much the cheaper of the two processes, but since the wine does not remain on the yeast deposit as long, it is not supposed to produce quite as good a quality of wine.

**Processing—Racking.**—After fermentation, the wines are cloudy from suspended material, mainly yeast, and contain an excess amount of carbon dioxide. Much of the suspended yeast precipitates out naturally when the wine is stored. The supernatant clear wine is then removed from the deposit (this is called racking) and transferred to a new container. During the process of racking a considerable amount of the excess carbon dioxide will also be lost. The clarification proceeds very rapidly during the period immediately after the completion of the fermentation, especially in small containers. The new wine is very subject to oxidation, and in order to prevent contact with oxygen in the air, the wine must be kept in full containers. Since the temperature gradually drops following fermentation, an air space will develop as a result of the contraction of the liquid in the containers. It is therefore necessary to fill the containers frequently (called topping), usually about once a week for the first few months. This is more important for table wines, especially whites, than for fortified wines.

**Filtration and Fining.**—While racking is the primary method of clarification, other measures are needed to get the wine into the brilliant condition which is necessary for bottling. Filtration is the most common procedure used for this purpose at the present time. Pad filters are usually used, the pads being made of asbestos fiber, in a variety of porosities. Filtration may be done roughly, to remove large amounts of suspended material, or very finely to remove the smaller

particles. Asbestos pads capable of removing microorganisms are available, and in some cases, particularly in Germany, where it is desired to bottle slightly sweet low-alcohol wines, a germ-proof filtration into the bottle is made so that no yeast cells will be present.

A very ancient process used for clarification is the addition of an organic or inorganic material which, as it settles in the container, physically or by absorption tends to remove the suspended material. This process is called fining. The common fining agents used at the present time are gelatin, isinglass, and bentonite. Bentonite is a clay material with tremendous swelling properties and is most commonly used for clarification of wines in the United States. Another method of clarification is centrifugation. This is occasionally used for grape juice in Germany, but is seldom employed by wineries in the United States.

**Other Processes.**—The new wines are also supersaturated with potassium acid tartrate (cream of tartar). Since this salt is less soluble at lower temperatures, one of the methods of removing the excess cream of tartar is to lower the temperature. This is one reason why storage in cool places is recommended for wines. If, however, the winery is situated in a warm region and the wine is stored in very large containers, the temperature will not be reduced sufficiently to precipitate the requisite amount of cream of tartar. In these cases, it is necessary to chill the wines in order to remove it. An alternative process is to pass the wine through a cation exchanger in which the potassium is exchanged for sodium. It is not necessary to do this for all of the wine, only for enough wine to reduce the potassium content of the blend sufficiently so that potassium acid tartrate will not precipitate. Sodium acid tartrate is very soluble.

Pasteurization was originally devised by Louis Pasteur to kill harmful bacteria in wines. However, with the use of sulphur dioxide and pure yeast cultures, it is very rare today for bacteria to develop in wines sufficiently to cause spoilage. Pasteurization is therefore seldom used in wineries to kill bacteria. Short-time, high-temperature heating is occasionally used to deactivate certain oxidizing enzymes which cause browning of wines. Longtime heating is used in Madeira and California for the production of wines of the Madeira and California sherry types. These wines are usually heated for three to four months at temperatures of 120° to 140° F. A slight caramelization and considerable oxidation occur during this process, which gives the wines their particular character.

**Aging.**—White table wines are aged in the wood for only very short periods of time, usually 6 to 12 months, before they are sufficiently bright to be bottled. In fact, dry white table wines retain more of their desirable fresh fruity flavor by being bottled when they are rather young. Sweet table wines may require a longer period of aging before they are sufficiently stable for bottling. Red table wines definitely require a longer period of aging in order to lose a sufficient amount of tannin and to attain the degree of oxidation desired; usually the aging of red table wines is continued for two to four years. Dessert wines, for economic reasons, are frequently kept in the wood for very short periods of time. However, they should be aged for a longer time in order to attain their best quality.

Wines are polish-filtered just before they are bottled. This involves filtering through a pad filter whose pores are very small. The bottles may have the traditional cork inserted, but in many cases screw caps are used in the United States.

Wines continue to age in the bottle. White wines will usually reach their maximum quality within six months to about two years after being bottled. Red wines, particularly those of higher tannin content, may continue to improve in quality for 10 to 15 years after bottling. Dessert wines, however, change very slowly after they are bottled, and some port ages very well in the bottle.

See also FERMENTATION; GRAPE AND GRAPE CULTURE; VERMOUTH.

MAYNARD A. AMERINE,

Professor of Enology, University of California.

#### 4. History

The present types of wine grapes are descended from older species indigenous to the mountains in Armenia, south of the Caucasus. Archaeological data indicate that viticulture probably began there and penetrated to Mesopotamia and Egypt well before 3000 B.C. Hence, the custom of drinking wine is at least 5,000 years old, and with viticulture it spread from the ancient Near East to Europe and the Far East.

The river valleys of Mesopotamia were unsuitable for viticulture and the production of wine and raisins. Wine, although a favorite drink with the rich, always remained an expensive commodity imported from the highlands, which seldom were dominated by the kings or city-states of Sumer, Assyria, or Babylonia. The popular drink of these countries was beer. Wine was also obtained from Helbon, near Damascus, whose wines are mentioned by the prophet Ezekiel (Ezekiel 27:18).

**Egypt.**—In ancient Egypt, wine was much more popular. Viticulture had been introduced in predynastic times, and we find in tombs even of the 1st dynasty (c. 3000 B.C.) that the body is lying on a layer of grapes, which would accompany the dead on his journey. The vineyards gradually spread south from the Nile delta and the suburbs of Memphis, the capital, and also to the oases of the western desert such as the Faiyum. The grapes from orchards and gardens were properly pressed by treading and fermented in cellars. Tax inspectors checked the quality of the wines, and inscriptions on the clay stoppers of the pottery jars give the details of the vintage, such as the name of the vineyard, date of the harvest and pressing, name of the vintner, and brand.

Scores of brands were known, and the Egyptians tried to improve them by importing new vines from Palestine and Syria. Still, the classical authors did not think much of Egyptian wines. In Syria and Palestine viticulture was second only to the cultivation of olives and figs, and their wines were better. In all these countries, wine was always diluted with water, a long-standing custom in Mediterranean regions, where pure potable water is not very common.

**Greece.**—The vine came to the Aegean Sea region long before the fall of Troy (c. 1184 B.C.). The natural curiosity of the Greeks led them to apply their latest botanical discoveries to viticulture. Aristotle's famous pupil, Theophrastus (d. about 287 B.C.), gives excellent instructions

winegrowers, and by his time many Greek tracts were specializing in the production of port wines to be exchanged abroad in the lack Sea or the western Mediterranean for odstuffs and goods. With the jars of wine went the drinking habits and all the vessels needed for urrying, storing, mixing, and drinking wines, which strongly affected Celtic art.

The Greeks also invented the beam press, a better way of producing grape juice than treading, and they coated their porous amphorae (ars) with resin, giving their wines the peculiar taste still proper to the modern Greek *retzinato*. They also introduced methods of combating the acidity of wine and concocted medicines by mixing or extracting herbs and fruit with wine. Wine also played its part in sauces, unguents, and cosmetics and as a general solvent. Greeks and Romans never drank pure wine. At their symposia the master of ceremonies indicated the percentage of water to be added.

The one-sided economy of the Greek homeland, founded on exports of quality wines to distant Greek bases, showed its weakness when regions such as southern Russia and Gaul began to grow their own wines and compete with those of Greece, spurring the mother country to improve its wines or suffer, as it did after the Roman domination began in 146 B.C.

**Rome.**—The Romans, too, were great wine lovers. Viticulture always formed part of the outline of their larger estates. Here again, the homeland suffered by specializing in viticulture, which necessitated importing cereals. The 150-ot Monte Testaccio in Rome, consisting of broken wine jars, testifies to the enormous quantities of cheap Spanish wine imported for the Roman plebs. Unenforceable edicts, such as that of Emperor Domitian in 92 A.D. to cut down the Spanish and Gaulish vineyards, could not stem the decline of Italian viticulture. In the early centuries of the Christian era, the Bordeaux region and the Rhône and Moselle valleys became centers of viticulture. Vines even appeared in the Roman villas of southern Britain. The Romans introduced many improvements, such as the screw press and cork stoppers (which allowed wines to be kept longer than the older straw or clay plugs), and from the Celtic tribes of the western Alps they adopted wooden tuns and vats to store and transport wines.

**Medieval and Early Modern Europe.**—The fall of the Roman Empire and the incursions of German and Asiatic tribes, Muslim armies, and Norse vikings caused the vine to disappear from England, northern France, Swabia, and eastern avaria. Medieval viticulture was a slow rediscovery of classical techniques, assisted by Christianity (as every parish sought to produce the wine needed for the church ritual) and by the fact that the Romanization of the beer-loving Celts had changed Spain, France, and parts of Germany into wine-drinking countries. The Near East, meanwhile, was lost to viticulture by the rise of Islam, though some peoples like the Persians still grew grapes and wrote beautiful verses on the virtues of wine.

In the West, the shipments of Bordeaux wines were few from the 5th to the 9th centuries, but when Henry Plantagenet, later King Henry II of England, married Eleanor of Aquitaine (1152) large consignments of Gascon "claret" flowed yearly to English ports. When King Edward III (r. 1327-1377) cut down the outflow

of English coin, part of the Bordeaux wine exports was taken over by Flemish and Dutch merchants, who traded salt and wine for timber and wheat with the countries adjoining the Baltic. By the 14th century, the sale of claret in western Europe had declined somewhat in favor of sweet wines from Portugal, Spain, and the Mediterranean. By that time viticulture was firmly reestablished along the Rhine and in Swabia, Franconia, and Thuringia, even crossing the Elbe into the Oder district. Rhenish and other hocks began to compete with clarets.

Handbooks on viticulture began to appear in the 13th century, when Arnaud de Villeneuve (1235?-1312) and Pietro Crescenzi (1230?-1310) wrote their books, which also dealt with "medical wines" and other pharmaceutical concoctions in which wine played the part of a solvent. During the Middle Ages, such wines as hippocras were often drunk as table wines. The series of epidemics called the Black Death (1348-1350) introduced the use of strong distilled alcohol as a solvent in such medicines, and after the epidemics were over the taste for strong spirits and liqueurs, originally conceived as cures for pestilence and disease, remained and set back the consumption of wine.

The 16th century saw the rise of "canary sack," a fortified wine of the sherry type made in the Azores and Madeira and celebrated by Shakespeare and Ben Jonson. In the 17th century came the introduction of sparkling champagne wine. The technique of its manufacture, discovered about 1668, was perfected by Dom Pierre Pérignon, who in 1670 became cellarer of the Benedictine abbey of Hautvillers. The 17th century also brought the rise of port wines. The Methuen Treaty of 1703 between England and Portugal, which reduced English duties on Portuguese wines one third below those paid on French wines, was a great stimulus to the consumption of port in England and northwestern Europe. The exports of French wine declined and did not recover until the middle of the 19th century.

**Modern Era.**—By the 19th century, viticulture had been established in North Africa and in the Cape Colony (South Africa), which began exporting "Constantia wines" from the vineyard of Groot Constantia, south of Cape Town, about 1800. Australian wines began to be exported about 1850. Wine growing was introduced into Argentina, Brazil, Peru, and Chile, but the product was largely for home consumption. Viticulture was established also in California (see following section *United States*) and by 1840 in Ontario. Spanish viticulture rose rapidly after 1840, and Burgundy wines were more widely appreciated by 1850. The wine trade was profoundly affected by the introduction of duties on alcoholic strength rather than on volume, and by the licensing system, such as that introduced in Great Britain by William E. Gladstone about 1860, which also imposed a high tax based on strength and thus worked to bring beer and imported French wines (especially light table wines) back into favor. Modern appreciation of vintage wines and customs of combining certain wines with special dishes developed in Victorian days.

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**United States.** The history of wine in the United States began when Leif Ericson landed on American soil, 500 years before Columbus was credited with its discovery. Ericson called the land *Vineland the Good* because of the profusion of grape vines he found here. Grapes were a staple food of the Indians, but there is no evidence that any Indian tribe collected the fruit or made wine. Capt. John Smith and other early colonists made small amounts of wine from wild grapes, but the product was thin and unpalatable.

**East.** From the 17th to the 19th century there were many attempts to acclimate the European grape, *V. vinifera*, to the eastern United States. Italian, French, and German vineyardists, winemakers, and vines were brought to various colonies in an effort to develop an American wine industry with the European grape, but none of these was permanently successful, and some of them were spectacular failures. Colonial America got most of its wine from Europe—Madeira was particularly popular. The failure of *V. vinifera* to develop in the eastern United States was due to unfavorable climatic conditions.

By the end of the 18th century, attention turned to the domestication of the native species, of which there were many: *V. riparia*, *V. labrusca*, *V. rotundifolia*, and others. The first domesticated native grape, the *V. labrusca*, was planted during the American Revolution by John Alexander. By 1801 the Alexander grape was flourishing in Indiana, beginning a wine industry there that prospered for many years.

The first commercially successful wine growing in the United States was established in York, Pa., by Thomas Eichelberger in 1818. That same year a Baptist deacon, Elijah Fay, began the first vineyard in the Chautauqua Grape Belt in New York, but it was not until 1830, after he replaced his wild grapes from New England with native Isabella and Catawba, that he produced his first ten gallons of wine.

The introduction of the Concord in 1852 led to its gradual spread throughout the eastern part of the United States, and by the time of the Civil War a number of promising native varieties were widely planted. These included the Alexander, Catawba, Concord, Isabella, Clinton, Herbemont, Norton, and Delaware. The wine produced from these native grapes had a "foxy" or "grape jelly" taste that modern methods have lightened or eliminated.

The first American champagne was made by Nicholas Longworth in Cincinnati in 1842. Although wines were made by small wineries in the East prior to 1850, the large-scale Eastern wine industry developed after that date, in the Chautauqua and Finger Lakes districts of New York and in the Carolinas, Missouri, Virginia, Pennsylvania, Michigan, Indiana, Illinois, New Jersey, Arkansas, and Ohio. In 1876, American wines won two awards at the Paris Exposition, and in 1900 they won three dozen medals for their excellence.

The most important Eastern wine industry is now in New York, with smaller plants producing in Ohio, Michigan, and elsewhere. While the number of wineries east of the Rocky Mountains is small, a number of these wineries are very modern in respect to the equipment installed and the processes employed.

Because they use native varieties of grapes or their hybrids, Eastern wines bear a family

relationship to one another and have a distinct aroma, owing to the presence of methyl anthranilate. (A few Eastern wines, made from *V. vinifera* or *V. rotundifolia*, do not have this aroma.) Both still and sparkling wines are produced. Considerable vermouth is also produced in the eastern United States, some blended with more or less California wine. (Wines labeled simply "American" usually have some California wine blended in.)

**California.** The California wine industry has a completely separate origin from that of the Atlantic seaboard. The Spanish priests in Mexico planted cuttings or seeds of some European varieties of *V. vinifera* in the 16th or 17th century, and from these was developed the Mission variety. Mission wines for sacramental purposes are known to have been made in California as early as 1609. In 1833, Jean Louis Vignes imported *V. vinifera* from France. The plants thrived in the warm California climate, and several varieties of this species were established.

After the establishment of the first mission in California proper in 1769, the Mission variety was planted rather widely there, and it is still grown. Wine was made at several of the California missions, as well as in a few vineyards in southern California prior to the Gold Rush of 1849. This wine often was fortified with brandy because the warm climate of southern California led to spoilage of the low-acid table wines. Some brandy made was also from the Mission and other varieties.

After the Gold Rush, the industry flourished to such an extent that San Francisco vintners began exporting their wine made from European vines, to England, Germany, Russia, China, and Australia. When the first transcontinental railroad was completed in 1869, California wines came to the midwestern and eastern markets, and the state became the leading wine producer in America.

After 1850, grape plantings were made throughout the state, and much of the California wine industry gradually moved to the northern part. It increased in size up to prohibition. The importation of numerous varieties from Europe by Agoston Haraszthy in 1862, the work of Eugene Woldemar Hilgard at the University of California on grape varieties between 1880 and 1892, and the development of the huge California Wine Association toward the end of the 19th century may be cited as landmarks of this period. Many California brands of wines were well known on Eastern markets at the time of prohibition. There was even a small export trade to Great Britain.

When prohibition began to stalk the country in 1880, the wine industry was struck a lethal blow. Kansas was the first state to go dry. By World War I, 33 of the 48 states had adopted prohibition laws. With the onset of national prohibition in 1920, winemaking in America virtually died, and it had to be reborn when the federal law was repealed in 1933. However, the industry's real awakening came after World War II when a steady rise in the consumption of table wine began in America. The industry that has flourished in Europe for centuries is but a few decades old in America.

Following repeal, over 700 commercial wineries were established in California, but many were merely home wineries, and they soon disappeared. Some of these California wineries are



among the most modern and efficiently operated wineries in the world; stainless steel and automation, for example, are used on a scale not equaled elsewhere. The most important wine-producing districts in California are in southern California, in the San Joaquin Valley, and in the coastal valleys of Sonoma, Napa, Alameda, and Santa Clara counties. A nonprofit organization, the Wine Institute, was organized in 1935 and has been active in stabilizing the industry.

All types of wines are produced: still and sparkling, table and dessert, and flavored. Since only *V. vinifera* varieties are used, California wines resemble European wines in flavor more than they do the wines made of native varieties in the eastern United States. The better California table wines are now labeled with the name of the variety from which they are produced.

In the last decade wine consumption in the United States has more than doubled. Nine out of every ten bottles of wine sold in America are made in America. The California wines made from the *Vinifera* brought here from France more closely resemble European wines, but even they are uniquely American. The *varietals* of the East are made mainly from native grapes, particularly Labrusca, Concord, and Catawba. The most exciting developments in modern wine-making are the experiments that are being conducted with French-American hybrids that could revolutionize the comparatively young wine industry in this country.

HELEN POWERS

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**VINEBERRY**, win'bēr-ē, the colloquial name of various plants, especially *Rubus phoenicolasius*. *phoenicolasius*, in the rose family, Rosaceae, a bush with arching, somewhat spiny stems which are covered with purplish red glandular hairs. The canes root at the tips. The three-lobed toothed leaves are densely white-hairy on lower surface. The panicle flowers have all white petals and a conspicuous bristly style which encloses the developing fruits. At maturity the fruits are red and about one half

inch in diameter. The wineberry is a native of eastern Asia. It was introduced as an ornamental plant because of its graceful stems and whitened leaves, and has escaped from cultivation. It is closely related to the cultivated raspberries. Various other plants are or have been called wineberry, including the red currant, *Ribes sativum*; the gooseberry, *Ribes Grossularia*; the mountain cranberry, *Vaccinium Vitis-Idaea*; the bilberry or whortleberry, *Vaccinium Myrtillus*; the grape, *Vitis vinifera*; the partially poisonous tutu, *Coriaria ruscifolia*, a shrub of New Zealand; and the makomako, *Aristotelia racemosa*, a tree native of New Zealand.

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**WINEBRENNER**, win'bren-ər, John (1797–1860), American religious leader. He was born near Walkersville, Md., on March 25, 1797, and was ordained in the German Reformed Church in 1820. In 1830, in Harrisburg, Pa., he established the Church of God, whose members regarded the Bible as the only rule of faith and practice. The denomination later became the Churches of God in North America. Winebrenner died in Harrisburg on Sept. 12, 1860.

**WINESBURG, OHIO**, wīnz'bûrg ô-hî'ô, a series of 23 short stories by Sherwood Anderson (q.v.), published in 1919. In a preliminary sketch the author explains his controlling point of view toward the chief characters in the stories: "It was the truths that made the people grotesques. The moment one of the people took one of the truths to himself, called it a truth, and tried to live his life by it, he became grotesque and the truth he embraced became a falsehood." Described in psychological rather than philosophical terms, Anderson's "grotesques" represent people who have been forced out of the focus of normality by oddities, repressions, or frustrations which, in time, take control and find overt expression through eccentric, explosive, and tragic acts.

*Hands*, for example, the first story of the group, tells of Wing Biddlebaum, a gifted teacher, whose innocent passion for touching and caressing everything and everybody is misinterpreted, costing him his rightful vocation in life. *Queer* is the story of Elmer Cowley, rendered queer by his obsession with the idea that he is thought queer by others. *Death* presents the essentials of a hysterically intense, repressed, yet significant emotional relationship between one of Winesburg's doctors, his patient, Elizabeth Willard, "a tired, gaunt old woman at forty-one," and her son George. Through her death, the son achieves a sudden, intuitive understanding of his mother's warped life. Sherwood Anderson's abrupt, intense, non-realistic technique is peculiarly effective in these stories, which resemble dream states.

**WINFIELD**, win'fēld, city, Kansas, seat of Cowley County, on the Walnut River, 39 miles by road southeast of Wichita. It is a trade and shipping center in an area where cattle, hogs, and poultry are raised, and wheat, alfalfa, and corn are grown. There are also oil wells in the vicinity. Establishments in the city process dairy, poultry, and meat products, prepare stock feeds, mill flour, and manufacture gas burners, barrels, water cans, oilfield equipment, and steel products.

There is an airport. Southwestern College, a coeducational Methodist institution, and St. John's, a Lutheran junior college, are situated here. Special emphasis is laid on music in the colleges and public schools. At the northeast edge of the city is the Winfield State Hospital and Training Center for subnormal persons. Winfield was incorporated as a third-class city in 1873 and a second-class city in 1879. The commission-manager form of government was adopted in 1923. Population: 11,931.

DOROTHY BRATTON.

**WINFRID.** See BONIFACE, SAINT.

**WING.** See AERODYNAMICS; BAT; BIRD—*Flight*; FEATHER; FLIGHT, ANIMAL; FLY; INSECT—*Wings* and *Classification of Insects*.

**WINGATE**, wīn'gīt, **Orde Charles**, British army officer: b. Naini Tal, India, Feb. 26, 1903; d. Assam, March 24, 1944. Son of a British officer in India, he was educated at the Royal Military Academy, Woolwich, and commissioned in the Royal Artillery in 1923. He subsequently studied Arabic, served in the Sudan, and then in Palestine (1936-1939), where he was decorated for organizing night patrols which helped to protect Jewish settlements from Arab attacks. In 1941, while a temporary lieutenant colonel, he slipped into Ethiopia with Emperor Haile Selassie. Together the two of them organized a force of under 2,000 men that killed or captured large numbers of Italians. They succeeded in restoring the Emperor Haile Selassie to the throne in less than four months.

In 1942 Wingate was sent to India, where he formulated a plan for the reconquest of Burma by operating behind Japanese lines. Promoted brigadier, he trained a force of Gurkhas, British, and Burmese in rigorous jungle warfare and led them on a sustained raid (February-May 1943) across the Chindwin River, wrecking Japanese communications. His own supplies came wholly by air. In March 1944, as major general, he took a larger force by air 200 miles (320 kilometers) behind Japanese lines in Burma, but Wingate was killed in a plane crash a short while after the operation began. He was one of the most successful leaders of this type of warfare in World War II.

**WINGED LION**, wīngd lī'ən, the symbol of the evangelist St. Mark, which was adopted as the heraldic device of the Venetian Republic. A celebrated bronze figure of the winged lion of St. Mark surmounting a magnificent red granite column, formed out of a single block, stands in the Piazzetta of St. Mark at Venice.

**WINGED VICTORY OF SAMOTHRACE**, wīngd vīk'tər-ē, sām'ō-thrās, a statue of the Greek goddess Nike (q.v.), discovered in more than 300 fragments on the island of Samothrace, Greece, in 1863, but restored in 1875 and now in the Louvre Museum, Paris. A fingerless right hand and one finger, apparently belonging to the statue and found on the island in 1950, were presented to the Louvre in 1955. The sculptor was an unknown Rhodian, who carved the *Victory* in heroic size, from marble, about 200 B.C. Standing on a pedestal shaped like a ship's prow, the statue is headless and armless; its widespread wings appear to quiver. The body leans

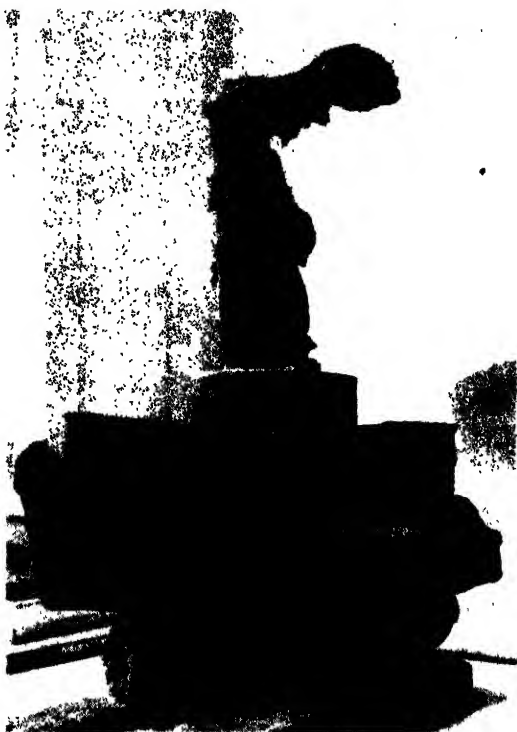


Photo Bulloz

*The Winged Victory of Samothrace.*

slightly forward, as if breasting a sea breeze, which presses the dress over swelling bosom and curved hips. Judging from numismatic representations of other figures of Nike, some scholars suppose that the right hand held a horn to sound the battle signal and the left hand carried a wreath or a small flagstaff. In dignity of conception and in masterly treatment of wind-swept drapery, the *Victory* is probably the finest extant example of early Hellenistic art. The older view that the statue commemorates the naval victory of King Demetrius I Poliorcetes of Macedon over Ptolemy I Soter of Egypt off Salamis, Cyprus, in 306 B.C., is no longer held valid.

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**WINGHAM**, wīng'am, town, Ontario, Canada, in Huron County, about 110 miles west of Toronto at the confluence of the Maitland and Middle Maitland rivers, which furnished power for its early industries.

Served by Canadian National and Canadian Pacific railways, it is a shipping center for grain and livestock, and a service and educational center for the surrounding general farming area. Industries include gristmills, sawmills, and furniture and woodworking plants. The area was settled in the 1830's, and the town was incorporated in 1879. Population: 2,897.

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**WINGS OF THE DOVE**, *The*, a novel by Henry James (q.v.), published in 1902. The central idea, which James said later he had had long in mind, is "that of a young person conscious of a

great capacity for life, but early stricken; . . . aware . . . of the condemnation and passionately desiring to 'put in' before extinction as many of the finer vibrations as possible, and so achieve, however briefly and brokenly, the sense of having lived." The "young person" of the novel is Milly Theale, an American heiress doomed to die of some obscure malady. Her friend, Kate Croy, is engaged to Merton Densher, a poor journalist, but conceals the engagement from her aunt, Mrs. Lowder, her only hope of wealth. Milly is attracted to Densher, and Kate suggests that he marry Milly to secure a fortune on which they can marry after Milly's death. The scheme, partly carried out, ends in frustration and defeat for all concerned. The novel stands with *The Ambassadors* (1903) and *The Golden Bowl* (1904) at the summit of James' final method of subtle and detailed analysis of character. It is not a book for hasty readers.

**WINKELRIED**, vīng'kæl-rēt, Arnold, Swiss hero, who died on July 9, 1386, at the Battle of Sempach. At Sempach the Swiss in wedge formation attacked a tight line of numerically superior Austrian knights, who were heavily armored. Unable to gain headway, the attackers were in danger of being enveloped by the enemy flanks. It is said that by renewing the charge on his own, Winkelried drew so many pikes to himself that he opened a gap in the battle line, enabling the Swiss to break through and defeat the less mobile Austrians.

**WINKLER**, wīngk'lər, a town in Manitoba, Canada, about 70 miles (113 km) southwest of Winnipeg and 12 miles (19 km) north of the U.S. border. It is an agricultural and manufacturing center. Farm products from the surrounding area are processed there. Other products include machinery, metal, and plastics. The original settlers were Mennonite immigrants, and Mennonites still predominate in the town. Winkler was incorporated as a village in 1906 and as a town in 1954. Population: 5,926.

**WINNEBAGO, Lake**, wīn-ə-bā'gō, a lake in Wisconsin, the largest in the state, situated 55 miles (89 km) north-northwest of Milwaukee, in Calumet, Fond du Lac, and Winnebago counties. It lies about 750 feet (229 meters) above sea level, is about 30 miles (48 km) long and up to 10 miles (16 km) wide, and has an area of 215 square miles (556 sq km). The Fox River enters the lake at Oshkosh, on the western shore, and flows out at the lake's northwestern corner. With the Fox, which empties into Lake Michigan's Green Bay, and the Portage Canal connection to the Wisconsin River near the Fox's source, Lake Winnebago is part of a continuous waterway between the Great Lakes and Mississippi River. The lake contains an abundance of fish. On the eastern shore is a curious wall of stones pressed against the shore by ice expansion. The city of Fond du Lac is at the lake's southern end.

**WINNEBAGO INDIANS**, wīn-ə-bā'gō, an important North American Indian tribe of the Siouan linguistic family, closely related to the Oto, Iowa, and Missouri. Their name derives from the Sauk-Fox word *wīnīpyagohagi*, meaning "people of the stinking water." In early records they are often called the Stinkard Indians, from the translation of their name.

Their traditional homeland is the Green Bay area of Wisconsin. They moved back and forth across the state, and between 1825 and 1836 ceded their lands, piece by piece, in return for reservation status. They suffered greatly from forced removal and epidemics, and their estimated population of 5,000 in early times had dwindled to fewer than 1,500 by the time they finally were settled with the Omaha in Nebraska in 1863. The fact that the Winnebago were so widely scattered has made a census extremely difficult.

The Winnebago first were friendly with the French but slowly transferred their allegiance to the British. They fought against the Americans until the close of the Black Hawk War (1832) but thereafter remained peaceable.

The culture of the Winnebago is much the same as that of their Great Lakes Algonkian neighbors but is interesting because it represents a Siouan enclave in the midst of Algonkian peoples. Their religious beliefs are almost identical with those of the Dakota people, but their arts are those of forest folk. Although they have many ceremonies more closely reminiscent of the Dakota tribes, they have incorporated many features of the great Midéwiwin (Grand Medicine Society) healing rites of the Great Lakes Indians. They call themselves Hochangara, meaning "people of the real speech," which is an interesting allusion to their origin, for it supports the tradition that they were one of the mother tribes of the Siouan stock.

FREDERICK J. DOCKSTADER

Author of "Great North American Indians"

**WINNER**, wīn'ər, Septimus, American song writer: b. Philadelphia, Pa., May 11, 1827; d. there, Nov. 22, 1902. After learning as a youth to play the violin, he ran a music store in Philadelphia. His first successful song was *How Sweet Are the Roses* (1850), published under the pseudonym of Alice Hawthorne, as were many of his later compositions. Some of his earlier songs were known as Hawthorne Ballads. His most popular song was *Listen to the Mocking Bird* (1854), which he is said to have sold for \$5; 20 million copies were bought in the next 50 years. Another of his compositions was *Where, Oh Where, Is My Little Dog Gone?* (1864).

In 1862, Winner wrote *Give Us Back Our Old Commander: Little Mac, the People's Pride*, expressing popular sentiment in favor of reinstating Maj. Gen. George B. McClellan as Union commander. The federal authorities thought the song subversive and arrested Winner. He was released after promising to halt its sale.

Winner was an outstanding popularizer of music in the United States. He published more than 200 books of music arrangements and instruction.

**WINNETKA**, wī-net'kə, a village in Cook county, Ill., on Lake Michigan, 18 miles (29 km) north of downtown Chicago, of which it is a residential suburb. The name is probably from a Potawatomi Indian word meaning "beautiful place." The site, on the old Green Bay Trail, was first settled in 1836. The village was incorporated in 1869. Its school system is noted for the development in 1919 of the Winnetka Plan emphasizing ungraded individual work in elementary school. The Hadley School for the Blind was founded in Winnetka in 1922. Population: 12,174.



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Manitoba's Legislative Building, a Winnipeg landmark completed in 1929, was built in the Beaux-Arts style.

**WINNIPEG**, win'-ə-peg, the capital and largest city of the province of Manitoba. The city is in southern Manitoba, on the eastern edge of Canada's prairies, at the confluence of the Red and Assiniboine rivers. Winnipeg's location near the geographic center of Canada gave rise to the nickname "Bull's Eye of the Dominion"; its strategic location earned it the appellation "Gateway to the West"; and the city's economic functions in Canada as a whole—which were similar to those of Chicago in the United States—suggested the sobriquet "Chicago of the North." The name Winnipeg originated in the Indian name given to the lake 40 miles (64 km) north of the city—*winn*, meaning "muddy," and *nippe*, meaning "water."

A northern city with long, cold winters and short, hot summers, Winnipeg plays a critical role in Manitoba's economy. It contains over 60% of the province's population and an even higher proportion of its employees. It produces over 80% of its manufactured goods and accounts for over 60% of its retail sales. It is still preeminently a transportation center, but manufacturing and service industries are increasingly important. Winnipeg is a major cultural center of western Canada and has long held a reputation as the home of a thriving arts community. It is also a center for education and for sports.

Winnipeg is well known as an innovator in urban government. In 1972 the provincial government replaced more than a dozen municipal governments in the area with a single, 50-mem-

ber council to govern a metropolitan urban region of over a half million persons. The new creation was dubbed "Unicity." Its establishment was a notable event in North American urban development because for the first time an urban region had moved beyond two-tiered metropolitan government to a single, unified administration and council.

**Growth of the City.** The original street pattern took shape between incorporation in 1874 and the arrival of the transcontinental Canadian Pacific Railway in 1885. Streets followed the pattern of old river lots and fur-trade routes. The Canadian Pacific Railway played a critical role in Winnipeg's evolution. The company's tracks divided the city in two: an impoverished, ethnically heterogeneous North End and a prosperous, homogeneous Anglo-Saxon South End. By 1900 the corner of Portage Avenue and Main Street in the South End—reputed to be the windiest and the coldest corner of North America—had become the center of the city's commerce.

Like most other western North American cities, Winnipeg did not develop distinctive architectural styles for its major buildings; rather, the city's architects and builders imported styles from the cities of the east, anxious to overcome any suggestion of frontier status.

The city suffered from a disastrous flood of the Red River in 1950. A major rebuilding took place in the subsequent decade, a notable feature of which was the construction of the city's first major shopping center at Polo Park (1959).

Thereafter the pace of growth in Winnipeg was steady. The city possessed one of the most stable economies in Canada and neither enjoyed nor suffered from the dramatic growth cycles experienced by Toronto, Vancouver, and Calgary. Nonetheless, a building boom of major proportions occurred in the 1960's and 1970's. The urban landscape was altered by commercial, educational, recreational, and governmental building. New zones were created, and the character of old areas changed. New industrial parks were developed, large shopping complexes sprang up in the suburbs, and universities and colleges were expanded. In the center of the city, changes included the demolition in the 1960's of Winnipeg's famed 1886 city hall and the construction on the same Main Street site of a new city hall complex; the construction, across from city hall, of the Centennial Centre, which included a planetarium, concert hall, and provincial museum; and the erection of numerous high-rise structures that changed Winnipeg's skyline. This building activity was fueled by several unique public corporations, such as the North Portage Development Corporation. At the same time, the city council sought to increase recreational use of the city's only outstanding natural features—its two rivers. Bicycle paths, marinas, and parks are maintained throughout the urban area.

**Cultural and Sports Resources.** The city's acclaimed Royal Winnipeg Ballet and the Winnipeg Symphony Orchestra perform at the Centennial Centre, which is in the central city. Nearby are the well-known Manitoba Museum of Man and Nature, the Winnipeg Art Gallery, the Provincial Archives of Manitoba, the Manitoba Theatre Centre—one of the most important regional theaters in North America—and the Assiniboine

Park Zoo. The Royal Canadian Mint (one of only two in Canada, the other being in Ottawa) is on the outskirts of the city. Just north of the city is Lower Fort Garry, a historical restoration and national park. The Manitoba Music Festival and Folklorama, a festival of ethnic culture, both held annually, are among the largest such events in Canada.

Sports are popular in Winnipeg, especially football and curling. In both sports the city has excelled: the Winnipeg Blue Bombers, the city's Canadian Football League team, won its first Grey Cup championship in 1935 and has repeated this achievement many times since; Winnipeg curling rinks have taken the Brier prize with some frequency since Winnipeg's first win in 1947. Winnipeg's hockey team, the Jets, plays in the National Hockey League. Winnipeg was host to the 1967 Pan-American Games, which left the city a legacy of an Olympic-size swimming pool (home of the National Aquatic Hall of Fame), a cycling velodrome, a high school stadium, a track-and-field facility, and a rifle range.

**Other Places of Interest.** The provincial legislative buildings and the University of Winnipeg are downtown landmarks. To the east of the city center is the neighborhood of St. Boniface, which has one of the largest concentrations of French-Canadians in western Canada. Other major points of interest include the University of Manitoba, south of the city center; Red River Community College; and the Manitoba School for the Deaf. The Canadian Pacific Railway yards, located in the North End, are the largest privately owned yards in Canada.

In addition to several major and minor museums, Winnipeg has a historic area in the central city known as the Warehouse District, in which is found the continent's best collection of late

COURTESY ROYAL WINNIPEG BALLET

The Royal Winnipeg Ballet, founded in 1939, regularly performs classical and Romantic ballets, such as *Les Sylphides* (right). It is also known for its innovative modern repertoire.





19th and early 20th century warehouse buildings. Most have been renovated and contain offices, restaurants, retail outlets, and housing.

**History.** The first permanent settlement on the site of Winnipeg was established around a general store some distance from the future Hudson's Bay Company post of Upper Fort Garry, which was built on the bank of the Red River in 1821–1822. Winnipeg was incorporated as a city in 1874 even though it hardly resembled an urban settlement; it was at that time little more than a collection of motley buildings housing some 3,000 people.

The key event in Winnipeg's early history was the arrival of the Canadian Pacific Railway. Together with the city's key location on the edge of the western prairie, the arrival of the railroad made Winnipeg the strategic site for Canadian western expansion. For almost three decades following the completion of Canada's first transcontinental railway, Winnipeg enjoyed a level of growth and prosperity unequaled in the history of Canadian urban development. The railway opened the west to large-scale settlement and development, and Winnipeg's location made it the logical focus for both new transcontinental railways and the branch lines feeding them. Deliberate policy, in the form of tariffs that discouraged trade with the United States, ensured that the west would be dependent on commercial ties with Canada's eastern cities and that Winnipeg would be the key city in east-west trade.

While the rise of Winnipeg was meteoric, its relative decline was a slow process that began with a major recession in 1913 and was severely exacerbated by the Winnipeg General Strike of 1919. The strike crippled the city, pitting the city's government and its employers against the majority of its workers and prompting intervention by the federal government on the side of the employers. The strike also marked the high point of ethnic tensions in Winnipeg. The disension and bitterness aroused by the strike were not soon overcome. Still, by 1913, Winnipeg was the largest city in Western Canada and the region's industrial, financial, and marketing center. This solid position allowed Winnipeg to survive the severe depression of the 1930's, but even after the end of World War II it did not enjoy the frenzied rate of growth experienced prior to 1913.

The city did, however, adjust from being a "gateway city" to being a "central place city." While Winnipeg's once-vast western hinterland was severely reduced in size by the growth of other western cities, the city remained the largest metropolitan center in the prairie region. And although Edmonton and Calgary became major metropolitan centers in their own right, Winnipeg retained an effective sphere of influence in Manitoba, northwestern Ontario, and most of Saskatchewan. Thus Winnipeg continued to perform metropolitan functions for a large hinterland, providing financial, commercial, and other services.

Winnipeg became more cosmopolitan with each succeeding postwar decade until by 1960 the non-Anglo-Saxon population of the city had reached almost 60% of the total. Winnipeg had one of the most pronounced ethnic mixes of any urban area in Canada and, with the exception of the French and Italians, had a larger percentage of all ethnic groups represented in its metropolitan area than had the country itself.

Ethnic relationships in the city are organized around a wide variety of institutions. The city's Ukrainians, for example, have a thriving array of organizations, including a large number of distinctively designed churches—especially in North Winnipeg—as well as associations, clubs, and businesses including the Ukrainian Labour Temple and a variety of stores, bookshops, workshops, and restaurants. Most Winnipeggers have proved willing to accept enthusiastically a variety of cultures. The city's cosmopolitanism was affirmed by the beginning of Folklorama, an annual, weeklong ethnic festival, in 1970.

More recent trends in Winnipeg suggest the continued evolution of a cosmopolitan community. But overriding the decrease in ethnic discrimination and the increase in political and economic integration is the continued dominance of an Anglo-Saxon culture. What has evolved in Winnipeg is a culture that is more diverse but not fundamentally different from that established by 1900.

ALAN F. J. ARTIBISE  
*University of British Columbia*

**WINNIPEG, Lake**, win'ə-peg, a lake in south central Manitoba, Canada. One of the largest lakes in Canada, it is about 260 miles (416 km) long from north to south and covers an area of about 9,421 square miles (24,400 sq km). It lies at an elevation of 713 feet (217 meters). The lake's southern tip is about 40 miles (64 km) north-northeast of the city of Winnipeg.

Lake Winnipeg's chief tributaries are the Winnipeg River, from the east; the Red River, from the south; and the Dauphin and Saskatchewan rivers, from the west. The lake is drained to the north by a series of smaller lakes and the Nelson River, which flows into Hudson Bay.

The lake's name is derived from the Cree Indian words *win-nipi*, "murky waters." Discovered in 1733 by French-Canadian explorers led by Pierre de la Vérendrye, the lake and its tributaries were, until the railroad reached western Canada, an important route for fur traders, explorers, and settlers. Its fisheries are of major commercial importance. Its southern shore is a resort area for residents of Winnipeg.

**WINNIPEGOSIS, Lake**, win-ə-pə-gō'sis, a lake in southwestern Manitoba, Canada, to the northwest of Lake Manitoba and west of Lake Winnipeg. It is about 125 miles (200 km) long from north to south and has an area of about 2,073 square miles (5,370 sq km). It lies at an elevation of about 831 feet (253 meters).

The lake is separated from Lake Manitoba by only a short distance and drains into it by the Waterhen River. In the days of the fur trade, Lake Winnipeg was reached by a short portage north to Cedar Lake, which drains into Lake Winnipeg by the Saskatchewan River.

**WINNIPESAUKEE, Lake**, win-ə-pə-sō'kē, a lake in east central New Hampshire, approximately 27 miles (43 km) northeast of Concord. Winnepesaukee (also spelled Winnepesaukee) is 71 square miles (184 sq km) in area. The largest lake in the state, it is very irregular in outline, with many inlets and islands. About 25 miles (40 km) long, it is up to 12 miles (19 km) wide, with a maximum depth of about 300 feet (91 meters). The lake empties into the Winnepesaukee River, which flows southwest to Franklin,

where it joins the Pemigewasset to form the Merrimack River. There are several small towns on the lake shore, the largest being Wolfeboro, and many cottages and summer resorts.

**WINNISQUAM, Lake**, wīn'is-kwōm, lake, New Hampshire, in Belknap County. It enlarges from the Winnepesaukee River at Laconia and is connected by the river and bays with Lake Winnepesaukee a few miles to the east. Its general extent is from north to south, about  $7\frac{1}{2}$  miles, and it varies in width from  $\frac{1}{2}$  to 2 miles. Its outlet is by the river to the southwest. Winnisquam village is at the south end.

**WINONA**, wī-nō'nā, city, Minnesota, seat of Winona County, on the western side of the Mississippi River, 100 miles southeast of St. Paul. It is a trade and industrial center, with railroad repair shops and many food-processing plants, which handle cattle feed, flour, dairy products, and beverages. Bricks are manufactured, and limestone quarrying is important in the region. Patent medicines and cosmetics are also produced. There is an airport. Bridges cross the Mississippi to Wisconsin. Winona State College (q.v.) and two Roman Catholic institutions, St. Mary's College (men) and the College of St. Teresa (women), are situated here. Winona was founded in 1851 as a trading and lumbering point by a Mississippi steamboat captain, Orren Smith; it was incorporated in 1857. Its early prosperity was based on lumber milling and the grain trade. It has a mayor-council form of government. Pop. 25,399.

**WINONA STATE COLLEGE**, a state-supported educational institution in Winona, Minn. Established in 1858, it was the first normal school west of the Mississippi River. In 1921 it became Winona State Teachers College and in 1957 Winona State College. Degrees granted by the college are bachelor of science, which qualifies the graduate for teaching on the elementary or secondary level; bachelor of arts in liberal arts or business administration; the two-year associate in arts in liberal arts or secretarial work, and the master of science in education in areas of elementary teaching or administration, secondary teaching, and guidance and counseling. The college year consists of three quarters, and there are two five-week summer sessions. Athletic teams are known as the Warriors, and the school colors are royal purple and white. The average annual full-time enrollment is about 4,000.

NELS MINNÉ,  
President.

**WINOOSKI**, wī-nōōs'kē, city, Vermont, in Chittenden County, on the Winooski River across from Burlington to the south. It is a city of diversified industry, with bottling plants and manufactures of boxes and containers, concrete blocks, dresses, furniture, insulated wire, precision weighing instruments, and tools and dies. The Burlington airport is nearby. Winooski is the site of St. Michael's College, a liberal arts college for men, conducted by the Fathers of the Immaculate Conception. The name of the city is an American Indian word for "land of onions." Founded in 1787, it was incorporated in 1922. Government is administered by mayor and council. Pop. 549.

JOSEPH D. SULLIVAN.

**WINOOSKI RIVER or ONION RIVER**, river, Vermont, rising near Cabot, in the northeastern part of the state. It flows about 90 miles southwest and northwest past Montpelier and Waterbury, breaks through the Green Mountains, and passes Winooski and Burlington to empty into Lake Champlain north of Burlington. The river has cut deep picturesque gorges in places, and there are several falls, notably at Middlesex and Winooski, which furnish water power for manufacturing. After a destructive flood in 1927, three flood control dams were built on tributaries of the river between 1933 and 1937.

**WINSCHOTEN**, vīn'skhō-tān, town, the Netherlands, in Groningen Province, in the extreme northeast part of the country, near the German border. It is one terminus of the Winschoter Diep (canal), which extends to Groningen, about 20 miles northwest. Winschoten is an important market center, with dairy production, potato-flour milling, and meat-packing industries. It also manufactures agricultural machinery, chemicals, bicycles, and furniture. A brick church dates from the 13th century. Pop. (1957) 15,941.

**WINSLOW**, wīnz'lō, **Edward**, American colonist: b. Droitwich, Worcestershire, England, Oct. 18, 1595; d. at sea, between Hispaniola and Jamaica, West Indies, May 8, 1655. Born into a well-to-do family, he joined the English Separatist congregation at Leiden, the Netherlands, in 1617 and sailed for America with the first group on the *Mayflower* in 1620. A man of more substance and education than most of the Pilgrim Fathers, he was quickly accorded a place of leadership among them; thus when Chief Massasoit appeared at Plymouth in March 1621, it was Winslow who negotiated the original treaty with him. Winslow's wife died during the first hard winter in the New World, and in May 1621 he married Susanna White, widowed mother of Peregrine White, the first child born in the colony; this was the first marriage performed in New England. His account of the colonists' early explorations and relations with the Indians was probably incorporated by George Morton (q.v.) in the book known as *Mourt's Relation* (1622) and, if so, would be the first published record actually written in the colony.

Winslow returned to England on behalf of Plymouth Colony in 1623-1624 and 1624-1625, publishing *Good News from New England: or A true Relation of things very remarkable at the Plantation of Plimoth . . .* (1624) to encourage continued aid from the colony's backers in London. In 1629 he was made official agent, and he visited England repeatedly thereafter. On one of these visits, in 1635, he was imprisoned for four months at the instigation of Archbishop William Laud for alleged violations of ecclesiastical law.

Meanwhile, Winslow had been busy setting up trading posts in Maine, on Cape Ann, and along the Connecticut River, which laid the foundation for the colony's prosperity. In 1633, 1636, and 1644 he was chosen governor. His reputation as a colonial advocate was such that Massachusetts Bay recruited him in 1646 to defend its interest in England against attacks by Samuel Gorton (q.v.), whom Winslow answered in the tract *Hypocrisy Unmasked . . .* (1646). Caught up in the events of the English Civil War, he never returned to New England. In London, he was instrumental in founding (1649)

the Society for the Propagation of the Gospel in New England and published *The Glorious Progress of the Gospel among the Indians in New England* the same year. He held various appointments under the Commonwealth government and in 1654 was named chief of the civil commissioners who accompanied Adm. William Penn and Gen. Robert Venables in an attempt to seize the Spanish West Indies. He died of a fever during the campaign. Josiah Winslow (q.v.) was his son.

**WINSLOW, John**, American colonial army officer: b. Marshfield, Mass., May 10, 1703; d. Hingham, April 17, 1774. Grandson of Josiah Winslow (q.v.), he commanded colonial troops at the siege (1741) of Cartagena, New Granada (now Colombia), during the War of Jenkins' Ear and served in Nova Scotia (1744-1751) during and after King George's War. When the French and Indian War began, he led an expedition (1754) up the Kennebec River, where he established Fort Western (now Augusta, Me.) and Fort Halifax (now Winslow, Me.). As commander of the Massachusetts troops under British Lt. Col. (later Gen.) Robert Monckton, Winslow captured (1755) Fort Beauséjour, the last French stronghold on the Isthmus of Chignecto connecting Nova Scotia and New Brunswick, and reluctantly conducted the evacuation of the French population (Acadians) from the area. In 1756 he was put in command of a colonial force that was to take Crown Point on Lake Champlain, but the operation was called off by British headquarters, and Winslow retired from military service.

**WINSLOW, John Ancrum**, American naval officer: b. Wilmington, N.C., Nov. 19, 1811; d. Boston, Mass., Sept. 29, 1873. Appointed midshipman in 1827 through the influence of Daniel Webster, he fought with distinction in the Mexican War (1846-1848) and rose to captain (1862) during the Civil War while serving with the Mississippi flotilla. In 1863-1864 he commanded the *Keersarge* in European waters in pursuit of Confederate cruisers that were preying on Union commerce; and on June 19, 1864, off Cherbourg, France, he sank the Confederate ship *Alabama* in one of the most famous naval actions of the war (see *KEARSARGE, THE*). Winslow was promoted commodore and became a popular hero in the North. Later, as rear admiral, he commanded the Pacific Squadron (1870-1872).

**WINSLOW, Josiah**, American colonial governor: b. Plymouth, Mass., c. 1629; d. Marshfield, Dec. 18, 1680. Son of Edward Winslow (q.v.), he succeeded Myles Standish, who had died in 1656, as commander in chief of Plymouth Colony in 1659 and was one of Plymouth's two commissioners in the governing body of the United Colonies of New England from 1658 to 1672. In 1673 he was chosen governor of Plymouth, holding office until his death; he was thus the first native-born colonial governor in America. At the beginning of King Philip's War in 1675, Winslow was appointed commander in chief of the United Colonies' forces, but withdrew early the next year because of ill health. He established the first public school at Plymouth (1674). See also *UNITED STATES—The English Colonies in America, 1607-1763*.

**WINSLOW**, city, Arizona, in Navajo County, 60 miles east of Flagstaff and a mile west of the highway and railroad crossing of the Little Colorado River. It is a division point of the Atchison, Topeka and Santa Fe Railroad, and has sawmills producing ponderosa pine lumber, planing mills, and a molding mill. There is an airport. The Petrified Forest National Monument is 50 miles to the east, and Meteorite Crater 20 miles to the west. To the north is the Hopi and Navaho Indian country. Winslow was founded in 1882 and named for Edward F. Winslow, president of the St. Louis & San Francisco Railroad, then a subsidiary of the Atlantic and Pacific, which later was absorbed by the Santa Fe. The city was incorporated in 1900 under the council form of government and in 1957 adopted its own charter. Population: 8,190.

J. MORRIS RICHARDS

**WINSLOW**, town, Maine, in Kennebec County, 17 miles northeast of Augusta, on the east side of the Kennebec River at the influx of the Sebasticook, opposite Waterville. It is both an agricultural and industrial center. Dairy products and market gardening are important in the area, and the town has a major paper mill and poultry-processing plant. A blockhouse of Fort Halifax, built in 1754, is preserved. The town, settled in 1764 and named Kingsfield, was incorporated in 1771 as Winslow in honor of Maj. Gen. John Winslow, builder of Fort Halifax. Waterville, formerly part of Winslow, was incorporated separately in 1802. The town, which includes the unincorporated village of Winslow, is governed by three selectmen. Population: 7,997.

See also *WATERVILLE*.

FRANCIS J. MCCABE

**WINSOR**, win'zər, **Justin**, American librarian and historian: b. Boston, Mass., Jan 2, 1831; d. Cambridge, Oct. 22, 1897. His career as a historian began precociously in 1849 with the publication of *A History of the Town of Duxbury* while he was a freshman at Harvard, class of 1853. Leaving Harvard in 1852 without graduating, he traveled in Europe for two years, acquiring a wide command of languages. From 1854 to 1868 he lived in Boston as an independent man of letters, contributing poetry, criticism, and fiction to periodicals. In 1866 he was appointed a trustee of the Boston Public Library, founded a dozen years earlier as the first sizable library supported by municipal taxes. On the death of its first superintendent, Charles Coffin Jewett, in 1868, Winsor was, by the imaginative action of his fellow trustees, appointed Jewett's successor.

During the next nine years Winsor kept the institution at the head of the new public library movement and contributed notably to the creation of a profession of librarianship in America. Although he was a scholar by temperament, he liberalized library practices and brought books to the people of Boston in an unprecedented manner through the establishment of branches throughout the city. He was a founder of the American Library Association, its first president (1876-1885), president again in 1897, and a founder of the *Library Journal*. As superintendent of the Boston Public Library, he was the ideal man in the right place at the right time, but in 1877, when harassed by the petty maneuvers of Boston politicians, he resigned to be-

me librarian of Harvard University, a post that he held until his death.

In Cambridge, Winsor strengthened the Harvard College Library and embarked upon a regularly fruitful career of historical and cartographical contributions. He was editor of two great collaborative works: *Memorial History of Boston* (4 vols., 1880-81) and *Narrative and Critical History of America* (8 vols. 1889), which are still useful because of his meticulous bibliographical contributions. His own works include *Reader's Handbook of the American Revolution* (1880), *Christopher Columbus* . . . (1891), *Artisan to Frontenac* (1894), *The Mississippi Basin* (1895), and *The Westward Movement* (1897).

WALTER MUIR WHITEHILL  
Director and Librarian  
Boston Athenaeum

**INSTANLEY**, wīn'stən-lē, **Gerrard**, English communist: b. Lancashire, England, ?1609; d. England, ?1660. A leading Leveler (see LEVELERS), he first achieved prominence as the under of a small religioeconomic group of extreme Puritans, known as the Diggers because they tried to settle on and cultivate (dig) the common land. In April 1649 he led a small band of Diggers in their attempt to plant waste land at St. George's Hill, Walton-on-Thames, Surrey, and at nearby Cobham, asserting that all common people had "an undeniable equity" in farm and dwell on common land rent-free. The project aroused the hostility of their neighbors, and ultimately the Diggers were forcibly moved by the authorities. Their leader Winanley was arrested and fined. He was a pioneering communist who expounded his egalitarian ideas in *The New Law of Righteousness* . . . (1649). His ideas were enlarged in *The Law of Freedom* . . . (1652). The authorship of the stirring *Digger's Song* has been attributed to him.

ALLAN M. FRASER.

**INSTED**, wīn'stēd, city, Connecticut, in Litchfield County, in a region of hills and valleys at the confluence of the Still and Mad rivers, 9 miles north of Torrington and 27 miles northwest of Hartford. It is a retail and industrial center, where clocks have been made since 1807 and a hosiery company has been in operation more than 75 years. Other industries are the manufacture of miniature precision balls for bearings, electrical appliances, screw machine products, copper wire, transformers, shocks, and nylon pins. In the city are the Gilbert School, Beardsley Memorial Library, and the Litchfield County Hospital. Winsted is known as the Laurel City because of the abundant growth of mountain laurel in the area. Severely damaged by flood in 1955, it has undergone considerable development, and flood control measures have been taken. Winsted was originally chartered as a borough in 1856 and as a city in 1915. It has a council-manager form of government. Population: 8,254.

ROBERT C. SALE

**WINSTON-SALEM**, wīn'stən sāl'am, city, North Carolina, seat of Forsyth County, in the Piedmont region, 75 miles north-northeast of Charlotte by highway. It is one of the world's principal tobacco centers, with a large tobacco market, and manufacture of cigarettes and tobacco prod-

ucts is the leading industry. Large textile plants produce knitted wear, fabrics, and hosiery. Other products are electronic and air-conditioning equipment, furniture, boxes, and metal and dairy products. The city has an airport and is served by five federal and four state highways and by the Norfolk and Western, the Southern, and the Winston-Salem Southbound railroads, the latter a freight line. There is one television and six radio stations.

Salem College (Moravian, for women), Wake Forest College (Baptist, coeducational), and Winston-Salem Teachers College (coeducational) are situated in the city, which also has many parks and playgrounds and a community art center. The Moravian Church in America (Unitas Fratrum) maintains the headquarters of its Southern Province here. Among the old Moravian buildings are the Brothers House (1769), the Miksch Tobacco Shop (1771), the Community Store (1775), the Salem tavern (1784), the Boys' School (1794), and the Home Moravian Church (1800), with a graveyard called God's Acre, which has become famous for its Easter sunrise services.

Salem was founded in 1766 as a church community by a group of Moravians from Pennsylvania who had come to the region in 1753. In 1849, 51 acres of land north of the city were purchased from the Moravian congregation for the county seat of newly created Forsyth County, and in 1851 a legislative act gave it the name of Winston in honor of Maj. Joseph Winston, who distinguished himself in the American Revolution at the Battle of Kings Mountain (Oct. 7, 1780). The old city of Salem and the new city of Winston were consolidated in 1913. The government is by mayor and board of aldermen and -women under the city-manager form of administration, established in 1949. Population: 143,485.

PAUL S. BALLANCE  
Director of Libraries

**WINSTON-SALEM STATE UNIVERSITY**, The, a four-year coeducational state institution in Winston-Salem, N.C. Founded in 1892 as the Slater Industrial Academy, it was recognized by the state in 1895 and chartered in 1897 as the Slater Industrial and State Normal School. In 1925 the state granted the school a new charter, extended its curricula to four years above high school, changed its name to The Winston-Salem Teachers College, and empowered it to confer appropriate degrees. In 1953 a School of Nursing was added, and in 1957 the privileges of the school were further extended to include the liberal arts and any other specific training which the state Board of Higher Education should wish to include.

In 1969 the North Carolina General Assembly renamed the school. They designated it as Winston-Salem State University, making it a regional university as part of a program that enlarged the state system of higher education. The school confers the bachelor of arts and bachelor of science degrees. Its campus spreads out over a 55-acre site. The school colors are scarlet and white, and the athletic teams are known as the Rams.

**WINTER**, wīn'tər, **SIR James Spearman**, Newfoundland statesman: b. Lamaline, Newfoundland, Jan. 1, 1845; d. Toronto, Ontario, Canada,

Oct. 6, 1911. Called to the Newfoundland bar in 1867, he entered politics in 1873. While attorney general (1885-1889), he represented Newfoundland with great ability at the Washington Fisheries Conference of 1887-1888 and was knighted (1888). In 1889 he won a brilliant triumph in the celebrated Baird-Walker case before the Privy Council which upheld the right of Newfoundlanders to operate lobster factories on the French shore of Newfoundland. As leader of a delegation to London, Winter prepared a clear and vigorous defense of Newfoundland's position on the French Shore question in 1890 and three years later was made a judge of the Supreme Court, resigning in 1896 to lead the Conservative Party in the general election of 1897. The party was victorious and Winter became prime minister of Newfoundland (1897-1900). He resigned office after his defeat on a motion of no confidence arising out of the controversy over the Reid railway contract signed (1898) by his administration.

ALLAN M. FRASER

**WINTER** is the coldest season of the year. It begins at the winter solstice, the year's shortest day, and ends at the vernal equinox, when day and night are equally long. In the Northern Hemisphere, winter begins on or about December 22 and ends on or about March 21. In the Southern Hemisphere, winter begins on or about June 22 and ends on or about September 23. Winter occurs in different months in the Northern and Southern hemispheres because the orientation of each hemisphere with respect to the sun changes as the earth travels around the sun.

Except in tropical and polar regions, winter is sharply different from the preceding fall and the succeeding spring. It is marked by low temperatures, snowfalls, cold waves, and reduced sunlight. Most plants slow their growth or become dormant, and many animals hibernate or migrate to warmer regions. See also **SEASON**.

**WINTER CHERRY** (also known as **CHINESE LANTERN PLANT** and **BLADDER CHERRY**), a perennial (*Physalis alkekengi*) of the nightshade family, often grown as an annual. It has erect, usually unbranched, angled stems 16 to 24 inches high, growing from a thin, creeping rhizome. The leaves are 3 to 4 inches long and 1½ to 2 inches wide, ovate or somewhat squarish with a pointed tip and gradually tapering at the base of the leaf blade along the upper leafstalk. The flowers arise from the leaf axils and are yellowish white, about 1 inch across, broadly bell shaped with 5 recurving lobes. After the flower fades, the calyx soon enlarges to an inflated Japanese-lantern form, 2 inches long, and becomes bright red in color. Var. *gigantea* and *monstrosa*, sometimes offered by seedsmen, produce more conspicuous "lanterns." The inflated calyx encloses a globular, shiny, many-seeded berry which is edible and has a bitter flavor. The fruit has had some medicinal use, but the winter cherry is cultivated mostly for its brightly colored calyxes. Stems, with these attached, are often used for indoor arrangements. The plant has become naturalized in many areas of the United States, especially near gardens. It is native from southeastern Europe to Japan. The genus name *Physalis* is from the Greek *physallis* (bladder), for the inflated calyx characteristic.

HOWARD W. SWIFT

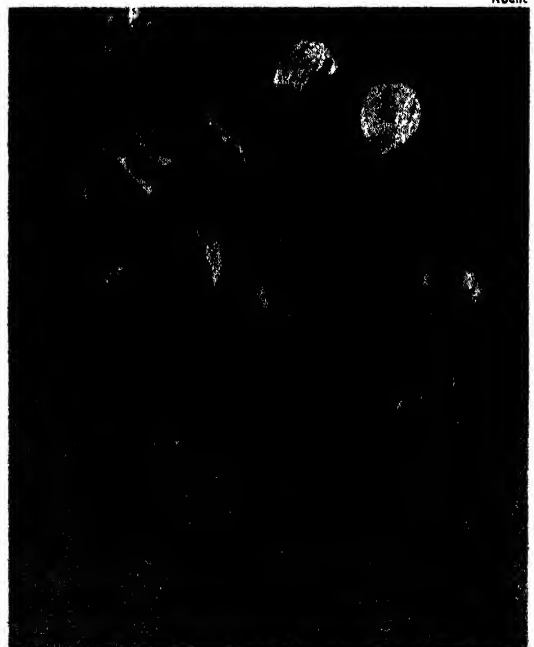
**WINTER HAVEN**, city, Florida, in Polk County, in the central part of the state, 14 miles east of Lakeland. Encircled by orange and grapefruit groves, it is a major center of the citrus-fruit industry, with packing and canning establishments and plants making various byproducts. Winter Haven is also a popular resort city with in easy reach of about 100 small lakes for boating, fishing, and swimming. The city-manager form of government was installed in 1923. Population: 24,725.

**WINTER PARK**, city, Florida, in Orange County, in the central part of the state, five miles north-northeast of Orlando. It is primarily a cultural and residential center. Tourists are attracted by the equable climate and the boating and fishing on the chain of four lakes in the vicinity. Winter Park is the home of Rollins College, a coeducational institution founded in 1885. Points of interest at the college are the Beal-Maltrie Shell Museum, the Morse Gallery of Art, and the Mills Memorial Library. An annual Bach festival also is held at the college. Attractions in the city are the Kraft Azalea Gardens and the Mead Botanical Gardens. Winter Park was founded in 1881 by Loring A. Chase and Oliver B. Chapman as a winter resort on the site of Lake View, a community begun in 1858. It was incorporated in 1887, and a new charter, providing a commission-manager form of government, was adopted in 1949. Population: 22,242.

RHEA MARSH SMITH  
Rollins College  
Winter Park, Fla.

**WINTERBERRY**, win'tər-bēr-ē, a common name for some species of the same genus as the holly (*Ilex*). The species most often known as winterberries are *I. verticillata*, common winterberry, Virginia winterberry, or sometimes black

Winter cherry, showing inflated lanternlike calyxes.





lder; *I. laevigata*, the smooth winterberry; and *I. glabra*, the evergreen winterberry, often called inkberry or gallberry. These three species are native to the eastern section of North America. The first two kinds are red fruited, giving a bright display of berries in the winter; the black-fruited evergreen winterberry is best known for its attractive year-round foliage. All are worthwhile garden subjects when grown under proper conditions, including sufficient moisture and somewhat acid soil, but they are difficult to transplant and slow to grow from seed. The common winterberry has been said to have poisonous berries, although the bark has been used for medicinal purposes. Leaves of evergreen winterberry and common winterberry have been used for tea after curing.

BETTY WILSON HIGINBOTHAM.

**WINTERGREEN**, win'tar-grën, a name applied to several plants of the family Ericaceae which retain their foliage over winter. In eastern North America, the aromatic little *Gaultheria procumbens* is generally the plant that is referred to by this name. It is a low shrub, barely six inches in height, which is found in rocky woods with creeping stems, half hidden, from which rise erect reddish branches, bearing ovate lossy leathery leaves. These are serrate with cristally tipped teeth and are gathered in a tuft at the top of the slender stalk, the fleshy white or pinkish urn-shaped flowers nodding underneath. The fruits are bright scarlet, mealy, and spicy in flavor and are really enlarged fleshy calyxes which have enclosed the seed capsules and assumed the form of berries. They are sometimes called checkerberries and remain throughout the winter. The whole plant is aromatic in taste and is frequently eaten, foliage, berries, and all. The spiciness is due to the volatile oil of *Gaultheria* which is a stimulant, astringent, and a purgative drug, but is chiefly used for flavoring confectionery or pharmaceutical preparations. It is a commercial product distilled from the wintergreen where it is plentiful, or from the sweet birch (*Betula lenta*).

The various members of the genus *Pyrola* are also called wintergreen, such as the round-leaved wintergreen, a common plant with a few orbicular or oval long-petioled coriaceous leaves. The flowers are somewhat like those of the lily of the valley and are fragrant. The spotted wintergreen (*Chimaphila maculata*) is another plant found in shady woods. It has a decumbent stem, sending up slender branches, which bear a few lanceolate leaves mottled with white and several white flowers, tinged with purple. Still another wintergreen is the chickweed wintergreen (*Trientalis americana*), a spring-blooming herb with a dainty white starry blossom poised above a whorl of foliage like tiny peach leaves.

**WINTERHALTER**, win'tar-häl-tär, Franz Xaver, German portrait painter and lithographer: b. Leuzenschwand, near Sankt Blasien, Baden, Germany, April 20, 1805; d. Frankfurt am Main, July 8, 1873. He studied at the academy in Munich, later in Karlsruhe, and finally in Italy. In 1834 he moved to Paris and gained the patronage of Louis Philippe, but his fame rests on his reputation as the "painter of the Second Empire" of Napoleon III. Most of his sitters were royalty or prominent members of their families. His most famous painting is *Empress Eugénie with Her Ladies-in-Waiting*, and the



Roche

The common or Virginia winterberry. (*Ilex verticillata*).

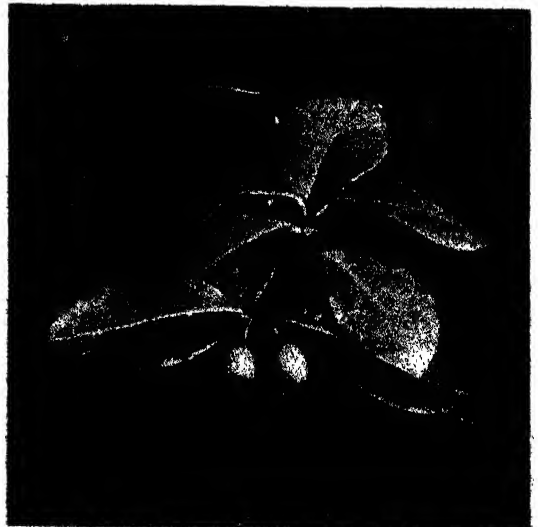
royal collections of England contain many portraits of Queen Victoria and her family.

Winterhalter's work has not gone out of fashion, unlike that of most of his contemporaries who specialized in "society" portraiture. This is partly due to his sound technical training, but mostly to the fact that he was able to invest his portraits with strong individuality, capturing for posterity the vitality of that vanished era of opulence.

JEAN ANNE VINCENT  
Author of "History of Art"

Wintergreen (*Gaultheria procumbens*), with berries.

Leonard Lee Rue III from National Audubon Society



**WINTERS**, win'tarz, Yvor, American critic, poet, and teacher: b. Chicago, Ill., Oct. 17, 1900; d. Palo Alto, Calif., Jan. 25, 1968. He studied at the universities of Chicago and Colorado and taught English at Stanford University from 1928, receiving his Ph. D. there in 1934. Winters' volumes of verse include *Poems* (1940), *The Giant Weapon* (1943), and *Collected Poems* (1952). He also edited *Twelve Poets of the Pacific* (1937) and *Poets of the Pacific: Second Series* (1949). Winters' chief critical works, collected under the title *In Defense of Reason* (1947), include *Primitivism and Decadence: a Study of American Experimental Poetry* (1937), *Maule's Curse: Seven Studies in the History of American Obscurantism* (1938), and *The Anatomy of Nonsense* (1943). Other works are the critical biography *Edwin Arlington Robinson* (1946) and a later collection of critical essays, *The Function of Criticism: Problems and Exercises* (1957). A examination of W. B. Yeats was published in 1960. He received the prestigious Bollinger Prize for *Poems*, (rev. ed. 1960). Among contemporary literary critics, Winters is distinctive in his emphasis upon the rational nature of poetic language and upon moral discipline as a function of poetry.

WALTER SUTTON

**WINTER'S TALE**, *The*, a tragicomedy by William Shakespeare, written about 1610-1611, produced in 1611 at the Globe Theatre and at court, and published in the folio of 1623. The source was a popular prose romance by Robert Greene, *Pandosto: the Triumph of Time* (1588). Leontes, king of Sicily, unwarrantedly jealous of the relations between his wife Hermione and his friend Polixenes, king of Bohemia, throws Hermione into prison, where she bears a daughter; Polixenes escapes. Paulina, wife of Antigonus, one of the Sicilian courtiers, brings the baby to Leontes, who orders her abandoned and refuses to believe in his queen's innocence until his son Mamillius dies and Paulina reports Hermione's death.

The abandoned infant daughter is found and reared by a shepherd in Bohemia where, as Perdita, she and Prince Florizel fall in love. Denounced by Polixenes, they flee to Sicily, where their identities are discovered. Leontes, still overcome with remorse, is invited by Paulina to see a statue of his wife. The statue proves to be the living Hermione, and all are joyfully reunited. Paulina, the rogue Autolycus, the pastoral episodes (reminiscent of Warwickshire), and the preservation of Hermione are Shakespeare's inventions to provide comedy and a happy ending; Greene's euphuized language is converted into lively prose and a verse which runs the gamut from the tortured staccato of Leontes to the lyrical utterances of the young lovers.

Criticism has stressed the insufficient motivation of Leontes' jealousy, the lapse of 16 years between Acts III and IV, the shift of interest in characters, and the surprise ending; but all this fails to take into account the play's title and type. A winter's tale was an old wives' tale, serious but not tragic, full of strange marvels and varied action, told around the hearth on winter nights; and tragicomedy demanded swift and violent emotions and a happy ending to its fantastic narrative. There is little pretense to realism: Leontes' repentance is as long as his jealousy; is sudden, a courtier is eaten by a

bear, a shepherdess is really a princess, and a dead woman comes to life. The unity is not one of plot but of atmosphere. Shakespeare gave his "scene such growing/As you had slept between"—between, that is, the waking, dozing, and dreaming which traditionally would accompany a winter's tale.

The playwright's skill and success are attested by the six court performances before 1642. The sophisticated Restoration would have none of the play, but it was revived in 1741, adapted as *Florizel and Perdita* by David Garrick, restored in the 19th century—Mary Anderson doubled as Hermione and Perdita in 1887—and is now frequently on the stage.

ROBERT HAMILTON BALL  
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Queens College,  
City University of New York

**WINTERSET**, win'tar-sēt, a drama by Maxwell Anderson (q.v.), produced in 1935. The play combines contemporary subject matter with the technique of poetic drama which Anderson had previously developed in his more traditional historical tragedies. The plot was suggested by the famous Sacco-Vanzetti case (q.v.). Mio, the protagonist, is the son of Romagna, a man who had been innocently executed for murder, and he is determined to carry out a lifelong obsession to avenge his father. But he falls in love when he meets Miriamne, the sister of the one witness who had it within her power to save his father. Anderson probes the moral dilemma of this situation, and when the real murderer appears, Mio, unfortunately, is helpless to act and loses his own life.

*Winterset* is now regarded as the playwright's best and most successful play. It falls short of great drama to the extent that Anderson cannot be called a great poet, but it is an excellent and representative work of American theater.

**WINTERTHUR**, vin'tar-tōor, city, Switzerland, in the Canton of Zurich, 12 miles northeast of Zurich. Its population is mainly German speaking. Located on a rolling plateau, it is both a railroad and industrial center, manufacturing cotton-mill, electric, and hydraulic machinery, as well as diesel engines and steam and electric locomotives for world export. It is noted for the Gothic Stadt-Kirche (1264-1515), with towers of later date; there are two castles (15th and 17th centuries), a museum of Roman antiquities, several libraries, and a museum devoted to paintings by Swiss artists.

Originally a Roman settlement known as Vitudurum, Winterthur in 1180 became the property of the counts of Kyburg. In 1264 it was sold to the Habsburgs, who maintained it as a stronghold until 1460, when the Swiss Confederates, in their struggle for liberty, conquered the Canton of Thurgau in which it was then located. It was sold to the Canton of Zurich seven years later.

In the 17th and 18th centuries Winterthur faience stoves enjoyed a great vogue in Europe; a notable collection of these is to be found in the industrial museum that is located there. In addition, Winterthur was the home of Anton Graff (1736-1813), who achieved fame as the court painter at Dresden. Population: (1977 est.) 87,900.



THE HENRY FRANCIS DU PONT WINTERTHUR MUSEUM

Winterthur Museum features period rooms from historic houses. Readbourne Parlor (above) is furnished in Queen Anne style. Montmorenci Stair Hall (right), with its graceful, free-hanging staircase, is from a house in North Carolina.



THE HENRY FRANCIS DU PONT WINTERTHUR MUSEUM

**WINTERTHUR MUSEUM**, win'tər-thər, a museum in Winterthur, Del., near Wilmington, noted for its collection of early American decorative arts. Situated in a great country house surrounded by a private park, the museum spans two centuries of American arts and crafts, dating from the 17th to the early 19th century. Nearly 200 period rooms and special displays contain thousands of objects, and include outstanding examples of domestic architecture, furniture, textiles, pewter, silver, ceramics, paintings, and prints.

**The Museum Collection.** Drawing rooms, parlors, dining rooms, bedrooms, and simulated outdoor settings, each complete to the final detail, survey the early American domestic scene. With very few exceptions, all the furniture, silver, and pewter on display was fashioned in colonial America or during the early years of the republic.

Winterthur is open to visitors daily except Sundays, Mondays, and major holidays. Tours of the main museum, which may be seen by appointment only, include the Court, reconstructed sections of house fronts that give the effect of a small village square; Shop Lane, a simulated

street lined with shop fronts; and interiors of the Queen-Anne, Chippendale, Federal, and Empire periods. No advance reservation is required for the South Wing, which contains 14 period rooms.

A favorite attraction is the Winterthur Gardens. These 60 acres (24 hectares) of naturalized plantings of trees, flowers, and shrubs are open without appointment from mid-April through October. The azaleas are at their peak in early May.

The museum also administers two fine colonial houses in Odessa, Del. The Corbit-Sharp House (built in 1774) and the Wilson-Warner House (1769) have been carefully restored and furnished with antiques. Both are open to the public.

**History.** The original house was built in 1839 by James Antoine Bidermann and his wife, the great-aunt of Henry Francis du Pont. After acquiring the estate in 1926, du Pont made numerous renovations and improvements, adding rooms from other historic houses along the Eastern Seaboard and furnishing them with antiques he had collected. The Henry Francis du Pont Winterthur Museum was opened in 1951.



AMERICAN ANTIQUARIAN SOCIETY

John Winthrop, governor of Massachusetts Bay Colony.

**WINTHROP**, win'thrəp, John, American colonial governor: b. Edwardstone, Suffolk, England, Jan. 12, 1588; d. Boston, Mass., March 26, 1649. As a youth he occupied a favored place, thanks largely to his grandfather, Adam Winthrop. After rising from apprentice clothworker to prosperous cloth merchant, Adam had acquired Groton Manor (1498) near Edwardstone, which passed to John's father, Adam, Jr., a lawyer. John's obscure early years were spent mainly in rural scenes. At the age of 14 he entered Trinity College, Cambridge, where he remained less than two years. While there, afflicted with a fever, "neglected and despised," and deprived of "youthful joys," he experienced a religious awakening, as a result of which he resolved to resist temptations, atone for past lapses, and seek the divine presence. Thereafter the religious strain in his nature, derived perhaps from his mother, Anne (Browne) Winthrop, was ascendant. He studied law, practiced successfully, served as justice of the peace, and was commissioned an attorney in the court of wards and liveries in London. In 1605 he married Mary Forth, who died in 1615; he then married Thomasine Clopton, who died on Dec. 8, 1616. His third marriage united him with Margaret Tyndal in April 1618. Soon afterward his father entrusted to him the care of the family estate, and he became lord of the manor of Groton.

Young Winthrop was drawn to Puritanism by his independent spirit, his sense of kinship with God, and his fondness for weighty sermons. After 1625 he became dissatisfied with his life in England. In 1629 Charles I attacked the Puritans and imprisoned their leaders; his aggressive prelate, Bishop William Laud, sought to subject them to beliefs and modes of worship that were offensive to them. Deprived of his commission as attorney in the court of wards and liveries, Winthrop came to feel that if he stayed in England, his talent for public affairs would

be "buried." He deplored the fact that hard times were making burdens of poor children, servants, and neighbors, whereas "if things were right, they would be the chiefest earthly blessing."

On March 4, 1629, Charles I chartered the Massachusetts Bay Company (q.v.). It included many Puritans among its members; several of them men of substance, who approached Winthrop with a proposal to settle in Massachusetts if he would lead them in building a Puritan commonwealth. In August 1629 he and 11 associates signed the Cambridge Agreement, pledging to move to Massachusetts if the company's charter and governing body (or General Court) might be transferred with them. The company soon agreed to this; Winthrop was then elected governor, and the great migration to Massachusetts began in the spring of 1630 with his departure in the *Arbella*.

For nearly 20 years Winthrop was the leading figure in Massachusetts, serving continuously as governor, deputy governor, or member of the Executive Council. His ideas and actions left a strong imprint on the colony. He disliked political democracy and thought that political authority should be vested only in people who were good and devout. Such a "spiritual aristocracy" would include persons of different social ranks. However, he preferred that government should be administered by a continuing elite composed of worthy men of wealth and good breeding. Such leaders should devote their talents to public service, acting as stewards of God to advance the coming of His kingdom on earth.

At the outset Winthrop wished to have the colony governed by a very small group of voters, members of the Massachusetts Bay Company, who had migrated in 1630. However, he yielded when a number of other settlers insisted that they be taken in as members of the company and allowed to vote. He then secured the adoption of a rule which required that voters must be members of a Puritan church. Afterward he tried so to curb the voters that they would merely elect the governor and his council; the latter would then exercise the principal legislative powers. Again he was forced to yield and to accept the demand of the voters that such powers be exercised by their deputies in the legislature (General Court). Later, in 1644, he sponsored an arrangement by which the council should act as a second house of the legislature, with a veto on the deputies, who were chosen by the voters in their towns.

When governor, Winthrop was lenient in dealing with individuals who committed personal offenses but stern in resisting opponents of the Puritan state. One of his foremost enemies was Anne Hutchinson (q.v.), leader of a group called Antinomians, who asserted that favored persons received messages directly from God which were presumably superior to the prosaic utterances of Puritan divines. When she implied that most of the ministers did not receive such messages, she threatened to destroy their influence as official guides of the people. She criticized her pastor at Boston and fomented strife within the church. Such "meddling" angered Winthrop, who thought that woman's place was in the home. He led a campaign against her which ended in her expulsion from the colony in 1637.

Not an original thinker, Winthrop was gifted

practical affairs and in the art of government. He brought much wealth to the colony; the sale of Groton Manor had netted him £4,200. He acquired a substantial landed estate in Massachusetts, which was worked by servants; he believed it proper that the labor of such workers should support leaders like himself, who devoted their energies to public service. He strove to rule with justice and mercy, and frowned upon usury, roflteering, luxury, and extravagance. Private estates, he said, cannot subsist in the ruin of the public, and he used much of his wealth for public purposes. Animated by religious faith and devoted to authority, rank, order, discipline, and public service, he believed that man should have liberty to do only what he and other strict Puritans deemed to be "good, just and honest." At the time of his death in 1649, the colony had been securely established.

Following his third wife's death in 1647, Winthrop had married a widow, Martha Cotycore of Boston. His four wives bore 16 children, of whom reached adulthood. His descendants of the Winthrop name were or are descended from his sons John, Jr., Adam, or Samuel.

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**WINTHROP, John**, American colonial governor: b. Groton, Suffolk, England, Feb. 12, 1606; d. Boston, Mass., April 5, 1676. The eldest son of John and Mary (Forth) Winthrop, he was educated at grammar school and at Trinity College, Dublin, and was admitted to the bar in 1625. When his father went to Massachusetts in 1630, he remained in England to dispose of the family estate. In 1631 he married Martha Fones, who accompanied him in August when he sailed for Boston with his stepmother and several of the Winthrop children. He immediately became a leader in the colony.

After the death of his wife in 1634, Winthrop returned to England, where he married Elizabeth Peade. He was then commissioned by William Pennes, 1st Viscount Saye and Sele, and Robert Treville, 2d Baron Brooke, to begin a settlement, Aybrook, on the Connecticut River—a work which he supervised after his return to Massachusetts in 1635. He finally settled in Connecticut and was elected governor in 1657; reelected in 1659, he held the governorship continuously for the rest of his life. In 1662 he secured from Charles II a charter for Connecticut which gave full sanction to the Puritan institutions that evolved there.

Theology meant less to Winthrop than science, particularly chemistry. He was elected a fellow of the Royal Society in London, to which he presented papers on the natural features of New England. Using a small telescope, he anticipated the discovery of a fifth satellite of Jupiter. He was also an amateur physician, whose cures

evidently owed more to his faith-inspiring presence than to his remedies.

Winthrop realized that New England was deficient in native products that could be exchanged in England for needed articles. He therefore tried to foster local industries for the production of salt, ironware, pitch, tar, and graphite—either to supply New England with finished goods or to increase its exports. He established two ironworks near Boston; although they soon failed, they proved that useful articles of iron could be made in New England. In 1651 Connecticut granted to him such lead, copper, or tin mines, salt springs, or deposits of antimony, vitriol, black lead, alum, stone salt, "or any other like" as he might find and develop within the colony. He also pioneered in proposing the issuance of paper currency by banks.

Winthrop was America's first outstanding industrial promoter, but he did not profit from his ventures; his wealth consisted mainly of land. He traveled extensively, and wherever he lived, his neighbors urged him to stay or to return; those at Ipswich spoke of him as "our Lieutenant Colonel so beloved of our soldiers." His industrial projects did not bear much fruit during his life: he was a pioneer, ahead of his time, who pointed out to successors the main lines of future development: mining, manufacturing, commerce, banking, medicine, chemistry, and discoveries in outer space. As an economist he perceived the special needs of undeveloped countries and devised plans for meeting them. One of his sons, John (known as Fitz-John) Winthrop (1638-1707, q.v.), became governor of Connecticut; another, Wait Still Winthrop (b. Feb. 27, 1642), served as chief justice of Massachusetts.

CURTIS P. NETTELS.

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**WINTHROP, John** (usually known as FITZ-JOHN WINTHROP), American colonial governor: b. Ipswich, Mass., March 14, 1638; d. Boston, Nov. 27, 1707. Son of John Winthrop (1606-1676, q.v.), he attended Harvard College but left to take a commission in the English Parliamentary Army, with which he served until the Restoration. Returning to America in 1663, he settled in Connecticut and eventually was elected to the General Assembly. Winthrop was made chief military officer for New London County in 1672 and took a prominent part in the Indian wars thereafter. During Sir Edmund Andros' administration as governor of the New England colonies, he sat on the council, but following Andros' overthrow (1689) he joined in reinstating Connecticut's separate government. The next year he was given command of an expedition against the French in Montreal; the promised supplies from Gov. Jacob Leisler of New York failed to arrive, however, and Winthrop canceled the mission. In an attempt to shift the blame from his own shoulders, Leisler arrested Winthrop and threatened to execute him, but Winthrop was rescued by local Indians of his own army. Exonerated by the Connecticut Assembly, he was rewarded and again took his place in the government of the colony. He was governor of Connecticut from 1698 until his death and enjoyed great popularity among the citizens.



**WINTHROP, John**, American scientist: b. Boston, Mass., Dec. 19, 1714; d. Cambridge, May 3, 1779. A descendant of the first John Winthrop, he graduated from Harvard College in 1732, and from 1738 until his death was Hollis professor of mathematics and natural philosophy there. Winthrop was one of the outstanding American scientists of the 18th century and exercised much influence on the thought of his contemporaries, including Benjamin Franklin and Benjamin Thompson (Count Rumford). His research was published in the *Transactions* of the Royal Society of London, and he was elected to the society in 1766.

Among Winthrop's important scientific studies should be mentioned his sunspot observations (1739) and his study of the transit of Mercury over the sun (1740, 1743, 1769). At Harvard he established the first laboratory of experimental physics in America (1746) and inaugurated the study of differential and integral calculus in the curriculum (1751). During the transit of Venus in 1761, Winthrop, under the auspices of Harvard, led the first astronomical expedition to St. John's, Newfoundland. During the American Revolution he supported the cause of the colonies and acted as an adviser to George Washington.

**WINTHROP**, town, Massachusetts, in Suffolk County, about four miles northeast of Boston. Situated on the peninsula enclosing Boston Harbor on the north and east, it is a residential suburban community with no major industries. Several yacht clubs have headquarters here. Settled in 1635 and named for Gov. John Winthrop, it was incorporated in 1852 upon being separated from North Chelsea. Winthrop has the representative town meeting form of government. Population: 18,127.

**WIRE**, wir, a filament of metal of uniform diameter. In modern practice it is formed by drawing the metal through a succession of wire-drawing dies, each one progressively smaller than the preceding one, until it has been reduced in diameter to the desired finished size.

**Drawing.**—The starting point in the manufacture of wire is rod, which conventionally is formed by hot-rolling wire billets or bars to standard diameters of  $\frac{1}{2}$  (more accurately 15/32),  $\frac{3}{8}$ , or  $\frac{1}{4}$  inch. For heavy wire products the finishing size may be larger. The rod is then drawn into wire in wire-drawing machines. A broad distinction between rod and wire is that rod is a hot-rolled and wire is a cold-drawn product.

Wire varies in size from approximately 1 inch down to 0.0004 inch in diameter. Some wire has been drawn smaller than this, but there is little commercial application for wire in the ultrafine sizes. A 0.0004-inch wire is approximately  $\frac{1}{20}$  the size of a human hair in thickness.

The material from which wire may be drawn is any ductile metallic element—iron, copper, aluminum, gold, silver, platinum, lead, zinc, tungsten, molybdenum, and many other metals, or combinations of these and other metallic elements to make alloys, which are mixtures of two or more elements. Most wire is drawn cold, that is, it enters the first die cold; but some metals, like very hard alloy steels, tungsten, and molybdenum, must be heated before they can be made sufficiently ductile to permit them to be drawn.

Reductions in the diameter of the wire are achieved by means of drawing dies, which are usually made of tungsten carbide or diamond. The first, which approximates the diamond in hardness, is used for all coarse and intermediate wire sizes; the second is used for fine wire, which is any size under 0.025 inch in diameter. Reductions of 25 percent in cross-sectional area are generally made in each pass through the die, but the percentage may vary up or down, depending on the metal and the results desired. Music wire, a high-carbon specialty wire of excellent quality, is drawn normally with reductions of only 10 percent per pass.

While the great bulk of wire is drawn round, it may also be drawn into other shapes. Flat wire is made by passing the wire through flattening rolls; other shapes, many of them quite complex, are produced by drawing round wire through specially shaped dies.

**Lubrication.**—All alloys of iron, of which steel is the principal one, are "dry drawn"; that is, the wire is passed through a lubricant box which is placed immediately ahead of the die and contains a powdered soap, tallow, or grease mixed with lime. This lubricant is essentially dry, but moist enough to be picked up by the wire in its passage through the box. Soluble soaps in a water solution or oils are used for many non-ferrous metals of any size, and always for wire of the fine-size range, the liquid lubricant being pumped over the dies to maintain continuous lubrication and facilitate cooling.

Lubricants of many special kinds have been developed for different metals, drawing conditions, and wire finishes. These lubricants may contain special additives, such as metallic stearates (salts of stearic acid) for metals like copper or aluminum, which help the base lubricant resist the great pressures and the heat developed in the process of drawing. For metals that must be heated before drawing, only such highly heat-resisting materials as graphite or molybdenum disulphide can be used as lubricants, as these substances will not burn or char.

**Rolling and Descaling Rod.**—In the process of hot-rolling wire rod, the material acquires a heavy oxide scale that must be removed before it can be drawn. This is accomplished by "pickling" the rod in a hot dilute bath of sulphuric or other acid. In the late 1950's a number of mechanical processes were developed for removing scale. These processes are generally in two stages: (1) shotblasting and flexing the rod over two or more sheaves in different planes, followed by (2) a brushing and air-cleaning operation to remove the loosened scale and dust. These methods, widely used in Europe, have found growing favor in the United States for some types of steel.

In the 1950's a new method of making aluminum rod found wide acceptance, principally among the larger independent producers. The process pours molten aluminum continuously into a rotating wheel mold, from which it passes into a series of rolls to be formed into rod. A somewhat similar process became available commercially in 1961 for producing copper rod.

**Annealing.**—Wire becomes work-hardened from drawing, since in the wire's passage through the dies the grains of metal are severely deformed and are under great internal stress. Experience has shown that each metal has a different work-hardening limit, beyond which, if further drawn,

is so brittle that it will break. This point may be reached after 4 to 8 passes through the drawing dies for steel wire, or 18 to 22 passes for iron or copper wire. When the wire arrives at this new state of hardness, it must be placed in an annealing furnace, heated to a temperature somewhat under its critical point (below melting), and allowed to remain there until all of the wire has become heated uniformly throughout. Annealing is a stress-relieving process of heat treatment by which the grains of the metal resume their normal shapes, thus becoming "soft annealed." Further drawing then can be done if necessary. Such annealing produces the softest and most ductile condition of the metal.

**Automation.**—Because of the many different types and sizes of wire manufactured in one mill, it has been difficult to achieve automation in the industry, but great strides have been made in this direction since 1950. There is a strong tendency to combine processing operations in one continuous train, when the production of one item is sufficiently large to justify this. One large mill producing communication wire has developed an automatic continuous line in which drawing, annealing, tinning, cleaning, insulating, and the final coiling of the wire on a take-up frame are combined and synchronized through electronic controls that require a minimum of attention. Similar operations, in less comprehensive combinations, exist throughout the industry.

**Finishes and Uses.**—Wire comes in an estimated 12,000 sizes, kinds, and finishes. It may be galvanized, aluminized, tinned, cadmium plated, rubber or plastic coated, or enameled. In fact, almost any metal may be plated onto a base metal for whatever finish is desired.

Some of the more common uses of wire are for fences, bolts, nuts, screws, rivets and washers, pins, needles, chains, wire ropes and cables, springs, trays, baskets, rings, staples, nails, wire cloth, concrete-reinforcing fabrics, and for that extensive class of products called electric wire and cable.

**Drawing Speeds and Bundle Sizes.**—Modern finishing speeds of wire are very high. Many mills will finish steel wire at a speed of 4,000 feet per minute and copper wire at speeds of 5,000 to 10,000 feet per minute. Paralleling this, modern continuous rod-rolling mill will turn out rod at a finishing speed of 6,000 feet per minute.

Wire now can be supplied in bundles of any weight desired; weights of 4,000 pounds of one continuous length of wire are produced by the simple practice of butt-welding one end of a rod to another by electric-resistance welding before the rod enters the wire-drawing machine. The only limitation to coil weight is the ability of the take-up equipment to handle or hold the wire. Much fine wire, however, is put up on reels or spools in 1-, 5-, and 25-pound weights, or heavier.

#### HISTORY

The history of wire is shrouded in antiquity. It is known, through archaeological discoveries, that wire was made in ancient China, Egypt, India, and some Middle East countries. Such wire usually was formed to make precious metal jewelry. In Exodus 28:22-26 the sacerdotal vestments of Aaron are described as being adorned with chains and rings of pure gold. These must have been made of wire. It is assumed that such

wire was not made by drawing, but by hammering out a piece of metal on an anvil, turning it constantly to keep it round. This hammering elongated the piece of metal until it assumed the desired diameter and length; most lengths, however, were quite short. Ornaments of gold wire have been found in the tombs of the Egyptian pharaohs, and in the ruins of Pompeii a section of a two-strand bronze wire was unearthed and is now on exhibition in a Naples museum.

**Middle Ages.**—During the Middle Ages one of the principal uses of wire was for making the rivets and flexible elements in armor. Reduction in size by hand-pulling through a die is known to have existed in the year 1000 A.D., and historians place the probable first use of a die about 300 years earlier. Crude samples of what are believed to be wire-drawing dies have been found in Europe. Some are iron and others are stone plates with holes of varying sizes drilled through them.

Rudolf of Nürnberg is credited with having developed, in 1350, a method of wire drawing which used water power. It was a closely guarded secret until 1500, when one Eobanus Hessus wrote in Latin a description of the process: "One can see how the work is done by the weight of wheels and with what great power they can stretch the iron and how they perform what a thousand men could not do before the art was discovered. A great wheel driven by the force of water drives with itself a powerful shaft whose surface is armed with many teeth and when this shaft is turned by the water power these teeth push and drag with them the parts of the machine which, although they resist, are unable to withstand the terrific force of the shaft, the wheel and the water. The tongs seize with their sharp teeth the raw iron, smooth it into round wire, which is taken out of the tongs and coiled into a thousand convolutions."

Records show that there were eight wire-drawing establishments in Paris in 1292, although there exists no description of their methods. A license to manufacture card wire (for carding wool) in England was granted by the crown in 1435 to the journeymen of card-wire drawers. Impetus was given to the English wire industry in 1564 when one William Humphrey brought a group of wire drawers into the country from Saxony. He established a mill known as the Tintern Abbey Works, where water was used for power.

**Beginnings in America.**—Manufacture of wire in the colonies prior to the American Revolution is not known to have existed. In 1640 the General Court of Massachusetts was petitioned for a grant of money to set up a wire-drawing establishment, the petitioner declaring that he had the necessary tools. This and subsequent petitions were not acted upon favorably. During the Revolutionary War a number of grants were made to assist qualified persons to manufacture card wire, but apparently all of the businesses shut down when the product became available from England again following the close of the war.

The War of 1812 brought about the reestablishment of a number of wire-making businesses in the United States. The only one known to have survived is the Spencer Wire Company, which has carried on continuously, despite changes of ownership and name. This and other early 19th century wire firms were located principally in or near Worcester, Mass. As transportation

tion and population moved westward, however, the wire industry also spread, and before the middle of the 19th century, wire mills were well established along the Ohio River in the Pittsburgh area, where coal was plentiful.

**The 19th and 20th Centuries.**—Five factors contributed to the rapid development of the art of wire drawing in the 19th and earlier 20th centuries: (1) the invention of the telegraph by Samuel F. B. Morse in 1835 and the installation of the first line between Baltimore and Washington in 1844; (2) the Homestead Act of 1862, which opened to settlement the great plains area of the West, increasing the need for fencing, principally barbed wire; (3) the development of the telephone by Alexander Graham Bell during the 1870's; (4) the invention in 1880 by Thomas A. Edison of the electric light, which required large quantities of wire; and (5) the development in Germany in 1926 of the carbide drawing die, introduced into the United States in 1928. (Carbides are a mixture of carbon, cobalt, and tungsten, pressed and fused together.)

Prior to the carbide-die era, wire drawing was still a slow procedure, although improved, hardened drawing plates had been developed. Carbide dies made the drawing of wire a considerably faster and more accurate manufacturing process. Since their invention, they have been improved further; drawing machine designs have also become more efficient, and larger and larger bundles (coils) of wire have been produced. As the demand for higher drawing speeds has increased, manufacturers have devised circulating water-cooling systems and air-cooling mechanisms to keep down the heat that is developed in the process of drawing, since lubricants for the dies and the dies themselves would have considerably shortened lives if the heat were not drawn off. With the adoption of the carbide wire-drawing die, the industry has evolved from an art to a science, in which such technicians as the metallurgist, the chemist, and the plant engineer prescribe the procedures and constantly check the results.

In the 20th century wire reaches into the lives and touches the experiences of everyone. Telephones, automobiles, electric lighting systems, household appliances, and even the wire-producing equipment itself would not be possible unless wire in some of its many forms was embodied in their construction.

See also NAILS; STEEL—3. *Manufacture (Drawing)*.

EDMUND D. SICKELS,  
Editor of "Wire and Wire Products."

**Further Reading:** Dove, A. B., *Steel Wire Handbook* (Steel Wire Handbook Comm. 1969); Lenk, John D., *Handbook of Simplified Commercial and Industrial Wiring Design* (Prentice-Hall 1964); Lidstone, John, *Building with Wire* (Van Nostrand Reinhold 1972); Minett, Michelle, *Wonders with Wire* (State Mutual Bk. 1985).

**WIRE GLASS**, a combination of wire and glass used in building construction, particularly for skylights and for office and factory windows. The glass may be polished, or it may contain any of a number of decorative figures on the surface. The wire netting is completely embedded in the glass during the process of manufacture. The temperature at which the wire is embedded in the molten glass insures cohesion between the metallic netting and the glass, and the two materials become as one, so that if the glass is broken by shock, intense heat, or other causes, it remains essentially

intact. Wire glass thus combines the strength of both the wire netting and the glass plate.

Wire glass will break, but it will not scatter. It can be fractured, but it will retain its place in its frame, so that the perils incident to falling glass and the ingress or egress of draft and flame are greatly minimized. For this reason, it has proved to be one of the most effective fire retardants available for building purposes, and its usefulness in this respect outweighs all other values. In addition, because of its mechanical strength, it eliminates the need for using half-inch glass in skylights.

The modern method of manufacturing wire glass is the continuous-rolling process, in which the molten glass flows from the spout of the furnace through a pair of water-cooled rolls which form it into a ribbon while chilling it and imprinting the figure on it. The ribbon of glass then travels through an annealing oven, after which it is cut to size. The wire netting, inserted continuously into the molten glass at the point of rolling, is pulled along by the motion of the ribbon itself and completely encased within the glass.

FRANK DORR.

**WIRETAPPING AND ELECTRONIC EAVESDROPPING** are methods used for overhearing a conversation without the knowledge of the participants in that conversation. Such secret listening by private individuals is condemned in the United States by federal law, a prohibition reinforced by legislation in most states.

It is a matter of serious controversy whether police officers in the investigation of crime should be permitted to tap wires, or to eavesdrop on conversations by using sensitive microphones—a technique often called "bugging." The argument in favor of police use of these methods is that the technique is an indispensable tool of effective police work in many cases, particularly in the investigation of organized crime, espionage, sedition, and kidnapping.

**A Historic Dissent.** In 1928 the U. S. Supreme Court held in *Olmstead v. United States* that wiretapping was not forbidden by the 4th Amendment to the Constitution. The language of that amendment forbids "unreasonable searches and seizures," and the majority of the court saw no "search" or "seizure" in the case of electronic interception performed at some distance from the location of the telephone instruments. Justice Louis Brandeis, however, delivered a classic dissent setting forth the main line of argument against eavesdropping, private or public. He spoke of the right "to be let alone—the most comprehensive of rights and the right most valued by civilized men. . . . It is . . . immaterial that the intrusion was in aid of law enforcement. Experience should teach us to be most on our guard to protect liberty when Government's purposes are beneficent. . . . The greatest dangers to liberty lurk in insidious encroachment by men of zeal, well-meaning but without understanding."

A second important objection that is made to electronic eavesdropping is that the police must hear many conversations in order to overhear those that may be evidence of crime. Thus it is impossible to protect the innocent or to respect the privilege of nondisclosure that the law affords some communications, such as those between doctor and patient, and lawyer and client.

**Subsequent Rulings.** After *Olmstead*, the Supreme Court held in *Nardone v. United States*

(1937) that wiretapping fell within the prohibition of section 805 of the Federal Communications Act, which forbids the interception and divulgence of any telephone conversation. The *Cardone* reading of federal law, however, was in effect a flat prohibition of all wiretapping, even that which might yield important evidence of a serious crime. Further, in practical results, the case did not operate to restrain wiretapping by state law enforcement officers.

In *Goldman v. United States* (1942), the Supreme Court held that it was not a violation of the 4th Amendment to overhear talk if one used a secret microphone not placed by trespass.

In the 1950's and 1960's several states, including New York, passed statutes forbidding all electronic eavesdropping (including wiretapping) unless done by police pursuant to a court order issued on information that the listener would discover evidence that crime was being committed.

Any form of eavesdropping raises a special 4th Amendment question because the amendment provides that warrants may not be issued unless they "particularly" describe "the place to be searched, and the . . . things to be seized." Obviously, one cannot describe conversations that will occur in the future.

*Berger v. New York* (1967) tested the constitutionality of the New York State law as it applied to a court-approved eavesdrop involving a microphone that had been placed by trespass in a person's office. The New York statute was held unconstitutional on the ground that the particularity requirement had not been met. The order had merely recited that "evidence of crime" would be obtained, without telling exactly what crime and what kind of conversations were anticipated.

Legal developments were carried a step further in *Katz v. United States* (1967). Federal officers monitored a public phone booth that was being used to carry on gambling operations. The government argued that the 4th Amendment's protection of privacy did not apply to certain places such as the phone booth and, further, that the monitoring device, unlike that in the *Berger* case, had been installed without committing a trespass. The Supreme Court disagreed on both points. The 4th Amendment, the court said, "protects people, not places." Further, the fact that the device had been installed without an unlawful entry was not significant. The speaker had no right to privacy not from physical intrusion into the booth, but from the "uninvited ear."

**Constitutional Limits.** The opinions in *Berger* and *Katz*, however, together with another opinion, *Osborn v. United States* (1966), suggest that some eavesdropping is permitted under the Constitution. It must be authorized by a judge, the judge's order must be based on a reasonable belief that evidence of a specific crime will be forthcoming, and it must be narrowly circumscribed as to the conversations to be heard and the time during which interception is permitted. In 1972, in *United States v. United States District Court for the Eastern District of Michigan*, a unanimous Supreme Court rejected a contention by the U.S. government that it had the right to engage in the wiretapping of domestic officials considered a threat to national security without first obtaining court approval.

MONRAD G. PAULSEN

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**WIREWORM**, wir'wûrm, the larva of any one of several species of beetle of the family Elateridae (q.v.), so called because they are cylindrical and elongate, with a hard, brown or yellowish, shining skin. The adult females lay their eggs in the soil about the roots of grasses and other plants. Upon hatching, the larvae feed on the roots and underground stems of many plants. A few live in rotten logs and are predacious on other larvae. Several years are usually necessary for development from egg to adult, most of this time being spent in the larval stage. They pupate in the soil and are among the most destructive of garden pests. Several species are very destructive to potatoes, rendering them unfit for sale. Corn and other cereal crops, wild grasses, and some leguminous field crops are often severely damaged by wireworms. Some millipedes, especially species of *Iulus*, are sometimes falsely called wireworms; they are similarly injurious.

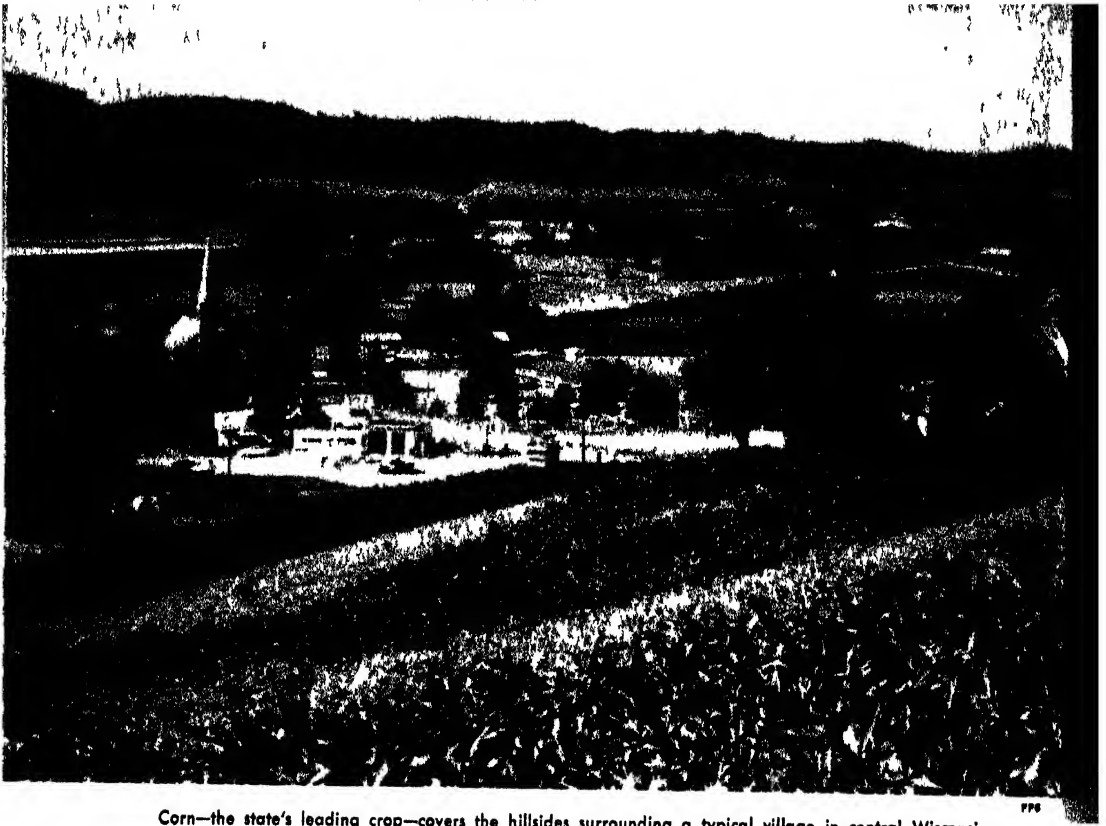
WILLIAM D. FIELD.

**WIRT**, wûrt, William, American lawyer, political leader, and author: b. Bladensburg, Maryland, November 8, 1772; d. Washington, D.C., Feb. 18, 1834. He received a grammar school education, studied law, was admitted to the bar in 1792, and began practice in Culpeper County, Va. While acting as assistant attorney in the prosecution of Aaron Burr for treason in 1807, Wirt demonstrated a learning and eloquence that was remarkable and established his reputation as one of the foremost lawyers in the country.

In 1817, Wirt was named attorney general of the United States by President James Monroe and served continuously until the end of John Quincy Adams' administration (1829), appearing in such famous cases as *McCulloch v. Maryland*, *Gibbons v. Ogden*, and the Dartmouth College case. He did much to systematize the operating methods of the department and was the first to preserve his opinions as precedents for the future. In 1832 he accepted the nomination to be the presidential candidate of the Anti-Masonic party, but the Whigs refused to adopt him as their nominee.

Wirt attained considerable fame as an author, especially for his series, *The Letters of the British Spy* (1803).

**WIRT**, William Albert, American educator: b. Markle, Ind., Jan. 21, 1874; d. Gary, March 11, 1938. Graduated from DePauw University in 1898, he was superintendent of schools at Bluffton, Ind. (1899-1907), and at Gary thereafter until his death. Wirt attracted national attention by splitting the student body of his schools into two "platoons" which alternated in the use of classroom facilities and recreational, shop, and laboratory facilities, increasing the efficient utilization of school plants. The system came to be known as the Gary plan or platoon plan. After 1914, Wirt helped to put the scheme into operation in the public school system of New York City, where it was branded by some politicians as undemocratic and was largely responsible for the defeat at the polls in 1918 of the city administration which had introduced it. The plan had considerable effect in increasing vocational and recreational components in school curricula throughout the United States. In 1929 a survey showed that 202 cities were using the platoon system, but by 1950 relatively few schools were continuing the program.

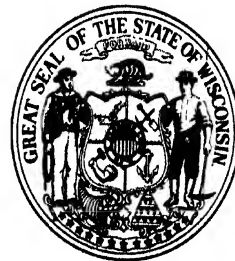


Corn—the state's leading crop—covers the hillsides surrounding a typical village in central Wisconsin.

# WISCONSIN

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State Seal of Wisconsin

**WISCONSIN**, wis-kon'sən, one of the east north central states of the United States. It is bounded on the north by Lake Superior and Upper Michigan, on the east by Lake Michigan, and on the south by Illinois; on the west it is separated from Iowa and Minnesota by the Mississippi River and by one of its tributaries, the St. Croix. Wisconsin's greatest width is 295 miles (475 km), and its greatest length 320 miles (515 km). The name "Wisconsin" comes from an Indian word for the principal river of the region, spelled Miscoos, Miskonsing, Mesconsin, and finally Ouisconsin by the French. It is usually interpreted to mean "gathering of the waters."

Although known as "America's Dairyland," Wisconsin is also an important industrial state, ranking 11th in the nation in value of manufactures. The state is noted for its varied and beautiful scenery, the lakes and forest region in the north being a favorite vacationland. Socially and economically, Wisconsin derived much strength from Yankee immigrants and from members of the many European groups who came to the area in the 19th century. The state was among the first to experiment in agricultural,

educational, social, and economic affairs with the "Wisconsin Idea," a philosophy of government introduced early in the 20th century that set the national pattern for much progressive legislation.

The state is known as the Badger State because the early miners who came into the region lived in mine shafts or dug their homes out of the hillsides in much the same way that badgers do.

## 1. The Land

Almost half of the state is covered with forests, and 1,690 square miles (4,377 sq km) are inland water and lakes. The great number of lakes and the natural beauty attract large numbers of sportsmen for the fishing, hunting, and winter sports such as tobogganing, skiing, and ice boating. The state is well known for its dairy products, breweries, and paper industry.

**Major Physical Divisions.** Wisconsin is a shield-like plain, but its surface is not that of a smooth,



## INFORMATION HIGHLIGHTS

**Location:** Wisconsin is an east north central state bounded on the north by Lake Superior and Upper Michigan, on the east by Lake Michigan, and on the south by Illinois; on the west it is separated from Iowa and Minnesota by the Mississippi River and one of its tributaries, the St. Croix.

**Elevation:** Highest point—Timms Hill, 1,952 feet (595 meters); lowest point—Lake Michigan, 581 feet (177 meters); approximate mean elevation—1,050 feet (314 meters).

**Total Area** (land and inland water): 56,153 square miles (145,436 sq km); rank, 26th.

**Resident Population:** 4,891,769 (1990 census). Increase (1980–1990), 4%.

**Climate:** Cool to cold winters, warm to hot summers, with sharp changes frequent; rainfall abundant, snow heavy in the north.

**Statehood:** May 29, 1848; order of admission, 30th.

**Origin of Name:** From the Indian name for the principal river of the region, spelled "Ouisconsin" by the French.

**Capital:** Madison.

**Largest City:** Milwaukee.

**Number of Counties:** 72.

**Principal Products:** Manufactures—engines, turbines, farm machinery, power cranes, machine tools, metalworking machinery, automobiles, truck and bus bodies, paper products; farm products—dairy products, corn, green peas, beans, cabbage, cranberries, snap beans, cattle, hogs, turkeys, milk; minerals—sand and gravel, granite, dolomite, zinc, clay, iron.

**State Motto:** "Forward."

**State Song:** On, Wisconsin.

**State Nickname:** Badger State.

**State Bird:** Robin.

**State Flower:** Wood violet.

**State Tree:** Sugar maple.

**State Flag:** The state coat of arms centered on a deep blue background. See also FLAG—Flags of the States.

mple plain. From the high land, about 1,650 feet (503 meters), in the north, it slopes gently downward all sides, reaching 500 to 600 feet (152–33 meters) above sea level at Lakes Superior and Michigan and at the Mississippi River. Glacial action and erosion have combined to give the state a varied and, in places, beautiful appearance.

The Northern Highland region covers the north-central section and is composed of rolling land and scattered glacial hills. Nested between the Highland and Lake Superior is the narrow Superior Lowland, which formerly was a part of the lake bed and now is deeply eroded by the swift streams that flow across it. The sprawling, sandy Central Plain, 65 miles (105 km) wide at its broadest point (north of the city of Portage), bounds the Northern Highland on the south. The Eastern Ridges and Lowlands cover

area inland from Lake Michigan to the Central Plain and from Marinette county to the Illinois border. This region is characterized by old limestone escarpments along the western edge and glacial hills called drumlins, kettle moines, and terminal moraines. Most of the West-

Upland is covered by the Driftless Area, a region that in the glacial age was an untouched and in a sea of ice. Continuous stream erosion has crisscrossed the limestone strata with narrow ridges and deep, steep-sided valleys. The Drift-

Area, which contains some of the most beautiful scenery in Wisconsin, has been compared with the valley of the Rhine.

**Rivers and Lakes.** A low arch running north-south a little east of the center of Wisconsin separates streams running into Green Bay and Lake Michigan from those that flow into the Mississippi. About 30 miles (48 km) south of

Lake Superior, running east and west, is a minor divide from which several small streams flow north into Lake Superior. A low divide in Columbia and Fond du Lac counties separates the Fox and Rock river drainage basins.

Chief among the westerly flowing streams are the St. Croix, Chippewa, Black, and Wisconsin, all of which rise in the Northern Highland. The Menominee, Oconto, Wolf, and Fox flow into Green Bay. Near Portage the Fox and Wisconsin were connected in the 19th century by a canal that is no longer used. The Manitowoc, Sheboygan, and Milwaukee rivers flow directly into Lake Michigan.

Every region of Wisconsin except the Driftless Area contains lakes, of which more than 8,500 have been charted. Lake Winnebago is the largest, with an area of 215 square miles (557 sq km), although it averages only 15 feet (4.5 meters) in depth. The Four Lakes (Menomata, Monona, Waubesa, and Kegonsa) provide a striking natural setting for the state capital, Madison. Other important lakes are Geneva, Koshkonong, Muskego, Shawano, Beaver Dam, Poygan, and the Oconomowoc and Waupaca groups. In the Northern Highland are two concentrations of small lakes. One is in Vilas, Oneida, and Iron counties and the other is in Washburn, Burnett, and several neighboring counties. All of these are lakes of great beauty, set in the midst of forests of birch, poplar, maple, and pine; the water is clear and deep.

Wisconsin's long shoreline on Lake Michigan first witnessed the arrival of French explorers in the 1600's.

LINDA WEIMER/UNIVERSITY OF WISCONSIN





WISCONSIN CONSERVATION DEPARTMENT

Wisconsin's more than 8,500 lakes are a result of glacial melting following the Ice Age.

Swampland is even more widespread in Wisconsin than lakes. Most of the swamps are in the northern lakes country, in the Central Plain, and in the Rock River valley. There are nearly 4,000 square miles (6,440 sq km) of undrained swamps and 7,000 square miles (11,265 sq km) of marshy and other poorly drained terrain.

Wisconsin has about 150 miles (240 km) of shoreline along Lake Superior and 380 miles (610 km) along Lake Michigan. The Bayfield Peninsula, Chequamegon Bay, and the Apostle Islands serve to break the Superior shoreline. Door Peninsula, Green Bay, Washington Island, and nearby small islands add variety to the Lake Michigan shoreline. While there are no natural harbors on Lake Michigan, excellent harbors have been created at river mouths to serve Milwaukee, Racine, Kenosha, Sheboygan, Manitowoc, Green Bay, and Marinette. On Lake Superior the harbors of Superior-Duluth, Ashland, and Port Wing are larger and better, being protected by sandspits that guard the inlets from wind and waves.

**Climate.** Wisconsin's climate is characterized by extremes of heat and cold and sharp changes caused by cyclonic storms that move across the region from west to east. Only the eastern edge of the state receives any benefit from the moderating influence of Lake Michigan. Extreme temperatures of 114° F and -54° F (46° C and -48° C) have been recorded, but the mean annual temperature ranges from 48° F (9° C) in the southwestern corner to 39° F (4° C) on the northern border. Temperatures below -20° F (-29° C) are infrequent, and summers, except for brief heat waves, are cool and pleasant.

The climate is ideal for agriculture. The state has as many as 170 growing days in the southeastern corner and an average of 120 or more days for all but the extreme Northern Highland, where the season may be as short as 75 days. Rainfall averages 27 to 34 inches (688-864 mm) per year, and 50% of it falls during the summer months. Snowfall averages 45 inches (1,143 mm) per year.

**Plant and Animal Life.** When the white man came to Wisconsin, most of the northern third of the state was covered with white pine. After the logging era ended, thousands of acres of pine were replanted in national, state, and county forests. Maple and oak are the most common trees in southern Wisconsin, but there also are great numbers of spruce, hemlock, cedar, birch, and elm. Huckleberries, Juneberries, raspberries, currants, blueberries, and other shrubs, as well as an endless variety of wild flowers, grow abundantly in many areas.

Each year many thousands of ducks, geese, and songbirds visit the state in the spring and fall. Wisconsin upland game birds include ring-necked pheasant, Hungarian partridge, quail, and sharp-tailed grouse. The Virginia white-tailed deer and the black bear are the only big game encountered in the state. Some wolves and wildcats can be found, and there are numerous small animals such as muskrat, beaver, raccoon, skunk, fox, woodchuck, and opossum. Wisconsin's lakes and streams are well stocked with trout, bass, pike, and muskellunge, and many smaller panfish. Lake trout, whitefish, herring, and perch are taken commercially from Lakes Superior and Michigan, and catfish and bass from the Mississippi.

**Natural Resources.** Water is one of the state's most beneficial resources. Lake Superior, Lake Michigan, and the Mississippi River provide an inexpensive form of transportation. The many inland lakes attract tourists, and rainfall is adequate enough to farm without irrigation.

Wisconsin's mineral output is limited, but the state does have deposits of iron ore, lead, and zinc. Sulfide deposits containing copper and zinc include those at Crandon, which constitute one of the largest supplies ever discovered in North America. Other minerals include basalt, clay, peat, quartzite, sandstone, limestone, and silica sand. Sand, gravel, and stone, including dolomite and granite, are also found in the state.

Forests cover almost half the land in Wisconsin, contributing to several of its important

# WISCONSIN

**COUNTIES**

COUNTIES		Antigua & Barbuda		MS		Camp Douglas 512		P8		Elkhorn 5,237		X10		Hilbert 1,211		K7	
ams 15,682	G7	Appletton 65,695	7	Arbor Vitae 900	64	Caroline 430	K10	Caroline 430	26	Elm Mount 785	C8	Elms 330	14	Elms 330	14	Elms 330	14
land 14,007	E3	Arden 2,186	07	Arden 2,186	07	Cascode 620	K8	Cascode 620	08	Elm Grove 6,281	K1	Elmhurst 1,288	38	Elmhurst 1,288	38	Elmhurst 1,288	38
ron 40,750	C5	Arena 525	39	Arena 525	39	Casco 544	L8	Casco 544	18	Elmwood 7,667	K6	Hingham 250	05	Hingham 250	05	Hingham 250	05
field 14,008	D3	Argonne 600	39	Argonne 600	39	Cashton 780	E8	Cashton 780	18	Elmwood Park 534	M3	Hixson 345	05	Hixson 345	05	Hixson 345	05
wn 194,594	D7	Argyle 798	G10	Argyle 798	G10	Cassville 1,144	E10	Cassville 1,144	10	Ely 1,533	F8	Holcombe 200	67	Holcombe 200	67	Holcombe 200	67
italo 13,584	C7	Arcansas 400	98	Arcansas 400	98	Cataraqt 200	E7	Cataraqt 200	10	Elton 150	J5	Hollenden 256	G10	Hollenden 256	G10	Hollenden 256	G10
nett 13,084	B4	Arlington 404	H9	Arlington 404	H9	Catawba 178	E4	Catawba 178	10	Embarass 481	J6	Holman 3,220	08	Holman 3,220	08	Holman 3,220	08
umet 34,291	K7	Armstrong Creek 615	K4	Armstrong Creek 615	K4	Cazenovia 288	F8	Cazenovia 288	10	Emerald 128	B5	Holy Cross 150	L9	Holy Cross 150	L9	Holy Cross 150	L9
ppewa 52,360	D5	Arpin 312	G6	Arpin 312	G6	Cedarburg 9,895	K6	Cedarburg 9,895	10	Endavor 316	G8	Honey Creek 300	J3	Honey Creek 300	J3	Honey Creek 300	J3
rk 31 647	E6	Ashippuri 750	H1	Ashippuri 750	H1	Cedarburg 9,895	L8	Cedarburg 9,895	10	Ephraim 261	M5	Horton 3,873	J9	Horton 3,873	J9	Horton 3,873	J9
umbia 45,088	H9	Ashland 8,895	E2	Ashland 8,895	E2	Cedar Grove 1,521	L8	Cedar Grove 1,521	10	Etter 481	D7	Hortonville 2,029	J7	Hortonville 2,029	J7	Hortonville 2,029	J7
wford 15,940	E9	Ashwaabeno 18,376	K7	Ashwaabeno 18,376	K7	Centuria 790	A5	Centuria 790	10	Evansville 3,174	H10	Houghton 915	A5	Houghton 915	A5	Houghton 915	A5
re 367,085	E9	Athens 951	G5	Athens 951	G5	Chaseburg 365	D8	Chaseburg 365	10	Evans 180	D4	Howard 6,874	K6	Howard 6,874	K6	Howard 6,874	K6
oge 76,559	J9	Auburndale 865	J9	Auburndale 865	J9	Chelsea 120	F5	Chelsea 120	10	Fairchild 304	D6	Howard Grove-Millersville	1,839	Howard Grove-Millersville	1,839	Howard Grove-Millersville	1,839
re 25,690	M6	Augusta 1,510	D6	Augusta 1,510	D6	Chenega 601	J1	Chenega 601	10	Fair Water 510	J8	Hudson 8,378	A1	Hudson 8,378	A1	Hudson 8,378	A1
rglas 41,758	C3	Auroraville 250	C7	Auroraville 250	C7	Chetek 1,953	C5	Chetek 1,953	10	Fall Creek 1,034	D6	Humboldt 190	E6	Humboldt 190	E6	Humboldt 190	E6
in 35 908	C6	Avoca 474	F9	Avoca 474	F9	Chilli 185	F6	Chilli 185	10	Fall River 642	D9	Hurley 1,782	F8	Hurley 1,782	F8	Hurley 1,782	F8
Claire 85,183	D6	Babcock 250	F7	Babcock 250	F7	Chiltona 3,240	K7	Chiltona 3,240	10	Fence 200	K4	Hustler 156	F8	Hustler 156	F8	Hustler 156	F8
ance 4,580	K4	Bagley 306	D10	Bagley 306	D10	Chippewa Falls 12,727	D8	Chippewa Falls 12,727	10	Fennimore 2,378	E9	Hustler 1,041	D7	Hustler 1,041	D7	Hustler 1,041	D7
du Lac 90,083	J4	Baileys Harbor 250	M5	Baileys Harbor 250	M5	Clam Lake 140	E3	Clam Lake 140	10	Fenwick 214	F6	Hustler 1,041	D7	Hustler 1,041	D7	Hustler 1,041	D7
st 6,776	K8	Baldwin 2,022	B6	Baldwin 2,022	B6	Clayton 450	B5	Clayton 450	10	Ferryville 154	D9	Hustler 1,041	D7	Hustler 1,041	D7	Hustler 1,041	D7
nt 49,264	E10	Balsam Lake 792	85	Balsam Lake 792	85	Clear Lake 932	B5	Clear Lake 932	10	Fish Creek 310	F4	Hustler 1,041	D7	Hustler 1,041	D7	Hustler 1,041	D7
en 30,339	G10	Bancroft 355	G7	Bancroft 355	G7	Clearwater Lake 200	H4	Clearwater Lake 200	10	Fish Creek 310	F4	Hustler 1,041	D7	Hustler 1,041	D7	Hustler 1,041	D7
en Lake 18,651	H8	Bangor 1,076	E8	Bangor 1,076	E8	Cleveland 1,398	L8	Cleveland 1,398	10	Florence 780	K4	Iota 1,125	H8	Iota 1,125	H8	Iota 1,125	H8
a 20,150	F9	Baraboo 4,903	G9	Baraboo 4,903	G9	Clinton 1,849	J10	Clinton 1,849	10	Fond du Lac 37,757	X10	Iron Belt 300	F3	Iron Belt 300	F3	Iron Belt 300	F3
6,153	F3	Barnes 225	D3	Barnes 225	D3	Clintonville 4,351	J6	Clintonville 4,351	10	Fond du Lac 37,757	X10	Iron Ridge 887	K9	Iron Ridge 887	K9	Iron Ridge 887	K9
son 16,588	F3	Barneveld 680	F10	Barneveld 680	F10	Clyman 370	J9	Clyman 370	10	Footville 764	H10	Iron River 878	D2	Iron River 878	D2	Iron River 878	D2
son 67,783	J9	Barron 2,986	C5	Barron 2,986	C5	Cobb 440	F10	Cobb 440	10	Forest Junction 140	K7	Ironton 200	F8	Ironton 200	F8	Ironton 200	F8
au 21,650	F8	Barronett 125	B4	Barronett 125	B4	Cochrane 475	C7	Cochrane 475	10	Forestville 470	J6	Ithaca 180	F9	Ithaca 180	F9	Ithaca 180	F9
osha 128,181	K10	Batavia 175	K8	Batavia 175	K8	Colby 1,532	F6	Colby 1,532	10	Forestville 470	J6	Ithaca 180	F9	Ithaca 180	F9	Ithaca 180	F9
aunes 18,878	D6	Bay City 578	B6	Bay City 578	B6	Coleman 839	L5	Coleman 839	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
rossie 97,904	L8	Bayfield 686	E2	Bayfield 686	E2	Coffax 1,110	C6	Coffax 1,110	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
yette 16,076	F10	Bayside 4,789	M1	Bayside 4,789	M1	Coloma 383	H7	Coloma 383	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
lade 19,905	H5	Beaer Creek 418	J6	Beaer Creek 418	J6	Columbus 4,093	H9	Columbus 4,093	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
oin 26,993	L7	Beaver Dam 14,196	J9	Beaver Dam 14,196	J9	Combined Locks 2,190	K7	Combined Locks 2,190	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
itowoc 80,421	G5	Beldenville 175	A6	Beldenville 175	A6	Commonwealth 240	K4	Commonwealth 240	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
stion 115,400	K6	Belgium 928	L8	Belgium 928	L8	Como 1,353	K10	Como 1,353	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
net 40,548	G5	Bell Center 127	E9	Bell Center 127	E9	Conestock 127	C5	Conestock 127	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
zette 12,321	H8	Belleville 1,456	G10	Belleville 1,456	G10	Concord 200	H1	Concord 200	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
unions 3,890	J5	Belmont 823	F10	Belmont 823	F10	Conover 480	J7	Conover 480	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
aukee 959,275	L9	Beloit 35,573	H10	Beloit 35,573	H10	Coon Valley 817	E8	Coon Valley 817	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
roe 36,633	E8	Bennett 350	C3	Bennett 350	C3	Cornell 1,541	D5	Cornell 1,541	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
ito 30,226	K6	Benton 898	F10	Benton 898	F10	Cornucopia 250	D2	Cornucopia 250	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
da 31,679	G4	Berlin 5,371	H8	Berlin 5,371	H8	Crandon 1,958	H4	Crandon 1,958	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
garnie 140,511	K7	Bethel 210	F6	Bethel 210	F6	Cream 120	L5	Cream 120	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
kee 72,830	L9	Beverly 200	H6	Beverly 200	H6	Cruz 996	L5	Cruz 996	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
7,107	C6	Big Bend 1,299	K2	Big Bend 1,299	K2	Cross Plains 2,098	G9	Cross Plains 2,098	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
e 32,785	B6	Birchwood 443	C4	Birchwood 443	C4	Cuba City 2,024	F10	Cuba City 2,024	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
34,773	G5	Birmamwood 693	H6	Birmamwood 693	H6	Cudahy 18,659	M2	Cudahy 18,659	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
ige 61,405	B6	Biron 794	G7	Biron 794	G7	Cumberland 2,163	C4	Cumberland 2,163	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
15,600	F4	Black Creek 1,152	K7	Black Creek 1,152	K7	Curtiss 173	F6	Curtiss 173	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
te 175,034	K10	Black Earth 1,248	G9	Black Earth 1,248	G9	Cushing 150	A4	Cushing 150	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
and 17,521	F9	Black River Falls 3,490	E7	Black River Falls 3,490	E7	Dale 410	J7	Dale 410	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
139,510	H10	Blackwell 550	J4	Blackwell 550	J4	Dallas 452	C5	Dallas 452	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
15,079	D5	Blair 1,126	D7	Blair 1,126	D7	Dalton 300	H8	Dalton 300	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
Croix 43,262	B5	Blanchardville 802	G10	Blanchardville 802	G10	Danbury 350	B3	Danbury 350	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
46,975	G9	Bloom City 167	E8	Bloom City 167	E8	Dane 621	G9	Dane 621	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
er 14 181	D4	Bloomer 3,085	D5	Bloomer 3,085	D5	Darien 1,158	F10	Darien 1,158	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
ano 37,157	J6	Bloomington 776	E10	Bloomington 776	E10	Darlington 2,235	J10	Darlington 2,235	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
nygan 103,877	L8	Blue Mounds 446	G9	Blue Mounds 446	G9	Deerfield 1,517	H9	Deerfield 1,517	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
18,901	E5	Blue River 438	E9	Blue River 438	E9	Deer Park 237	B5	Deer Park 237	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
sealeau 25,283	D7	Bohners Lake 1,553	K10	Bohners Lake 1,553	K10	De Forest 4,882	H9	De Forest 4,882	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
n 25,617	E8	Bonduel 1,210	K6	Bonduel 1,210	K6	Delafield 5,347	J1	Delafield 5,347	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
17,707	G3	Boscobel 2,706	E9	Boscobel 2,706	E9	Delavan 6,073	J10	Delavan 6,073	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
orth 75,000	J10	Boulder Junction 78	G3	Boulder Junction 78	G3	Delavan Lake 2,177	J10	Delavan Lake 2,177	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
burn 13,772	C4	Bowler 279	G7	Bowler 279	G7	Delwood 120	G7	Delwood 120	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
ington 95,328	K9	Boycerville 913	C5	Boycerville 913	C5	Denmark 1,612	L7	Denmark 1,612	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
esha 304,715	J6	Boyd 683	E6	Boyd 683	E6	De Pere 16,569	K7	De Pere 16,569	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
aca 46,104	K9	Brackett 150	D6	Brackett 150	D6	De Soto 326	D9	De Soto 326	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
tara 19,385	H7	Branch 300	L7	Branch 300	L7	Dickerville 882	E10	Dickerville 882	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
bago 140,320	J8	Brandon 872	J8	Brandon 872	J8	Dodge 185	D7	Dodge 185	10	Fort Atkinson 10,227	L10	Jackson 2,486	K9	Jackson 2,486	K9	Jackson 2,486	K9
73,605	F7	Brantwood 500	F4	Brantwood 500	F4	Dodgeville 3,882	F10	Dodgeville 3,882	10	Fort Atkinson 10,227	L10	J					

# WISCONSIN

Luxemburg 1,151	L6	North Freedom 591	G9	Ripon 7,241	J8	Tisch Mills 315	L7	Big Rib (riv.)	G5
Lyndon Station 474	F8	North Hudson 3,101	A5	River Falls 10,610	A8	Toman 7,570	F8	Black (riv.)	E7
Lynn 117	F6	North Lake 400	J1	River Hills 1,612	M1	Tomahawk 3,328	G5	Butternut (lake)	J4
Lynville 153	D9	North Prairie 1,322	J2	Roberts 1,043	A6	Tony 114	E5	Castle Rock (lake)	G8
Lyons 550	K10	Northwalk 554	E8	Rochester 978	K3	Townsend 450	K5	Cat (isl.)	E1
Madison (cap.) 191,282	H9	Oak Creek 19,513	M2	Rockdale 235	J10	Trago 280	C4	Chambers (isl.)	M5
Malden Rock 146	B6	Oakdale 182	F8	Rock Falls 200	C6	Trempealeau 1,039	C8	Chequamegon (bay)	E2
Manawa 1,189	J7	Oakfield 1,003	J8	Rockfield 200	L1	Troy Center 250	J2	Chetek (lake)	D4
Manchester 180	J8	Oconomowoc 10,993	H1	Rockland 509	D8	Tunnel City 200	E7	Chippewa (lake)	D7
Manitowoc 32,520	L7	Oconomowoc Lake 493	K5	Rock Springs 432	F8	Turtle Lake 817	B5	Chippewa (riv.)	B4
Maple 596	C2	Oconto 4,474	L6	Rome 200	H1	Twin Lakes 3,989	K11	Clam (lake)	B4
Maplewood 200	M6	Oconto Falls 2,584	K5	Rosendale 777	J8	Two Rivers 13,030	M7	Clam (riv.)	A4
Marathon 1,606	G6	Odanah 190	E2	Rosholt 512	H6	Union Center 197	F8	Deils Tre (valley)	G8
Marengo 130	E3	Ogdensburg 220	J7	Rothschild 3,310	G6	Union Grove 3,669	L3	Denoon (lake)	K2
Maribel 372	L7	Ogema 238	F5	Roxbury 280	G9	Unity 452	F6	Door (pen.)	M6
Marinette 11,843	L5	Okauchee 3,958	J1	Royalton 200	J7	Upson 115	F3	Du Bay (lake)	G8
Marion 1,242	J6	Okee 250	H9	Rozellville 150	G6	Valders 905	L7	Eagle (lake)	H2
Markesan 1,496	J8	Oliver 265	B2	Rubicon 261	K9	Verona 5,374	G9	Eagle (lake)	K3
Marquette 182	H8	Omo 2,836	J7	Rudolph 451	G7	Vesper 598	F7	Eau Claire (riv.)	D6
Marshall 2,329	H9	Onaska 11,284	D8	Saint Cloud 494	K8	Viola 644	E8	Flambeau (riv.)	E4
Marshfield 19,291	F8	Oneida 808	K7	Saint Croix Falls 1,640	A5	Viroqua 3,922	D8	Flambeau Flowage (res.)	K3
Martell 200	B8	Ontario 407	E8	Saint Francis 9,245	M2	Wabeno 800	J5	Fox (riv.)	F2
Mattoon 431	J5	Oostburg 1,931	L8	Saint Joseph Ridge 450	D8	Waldo 442	L8	Fox (riv.)	K7
Mauston 3,439	F9	Oregon 4,519	H10	Saint Nazianz 893	L7	Wales 2,471	J1	General Mitchell Field	M2
Mayville 4,374	K9	Orfordville 1,219	H10	Sand Creek 225	C5	Walworth 1,614	J10	Geneva (lake)	K10
Mazomanie 1,377	G9	Oscoda 2,075	A5	Sauk City 3,019	G9	Warrens 343	E7	Golden (lake)	H1
McFarland 5,232	H10	Oshkosh 55,006	J8	Saukville 3,695	L9	Washburna 2,285	D2	Green (bay)	L5
McLaughlin 450	H4	Owen 595	D6	Saxon 375	F3	Washington Island 550	M5	Grindstone (lake)	C4
Medford 4,283	F5	Oxford 499	F6	Sayner 300	H4	Waterford 2,431	K3	Holcombe Flowage (res.)	D5
Mellen 835	E3	Packwaukee 271	H8	Scandinavia 298	H7	Waterloo 2,712	J9	Jump (riv.)	E5
Melrose 551	E7	Paddock Lake 2,662	K10	Schofield 2,415	H6	Watertown 19,142	J8	Kegonsa (lake)	H10
Melville 115	E8	Palmira 1,539	H2	School Hill 228	L8	Waubesa 450	L9	Kickapoo (riv.)	E9
Menasha 14,711	J7	Pardeeville 1,630	H8	Seneca 235	E9	Waukesha 56,958	K1	Koshkonong (lake)	H10
Menomonee Falls 26,840	K1	Park Falls 3,104	F4	Sextonville 225	F9	Waumandee 115	C7	La Belle (lake)	H1
Menomonie 13,547	C8	Park Ridge 546	H6	Seymour 1,557	K6	Waukeesa 5,897	G9	Lac Court Oreilles Ind. Res.	D4
Mequon 18,885	L1	Park Grove 202	D10	Sharon 1,250	J11	Waupaca 4,957	H7	Lac du Flambeau Ind. Res.	G3
Merrill 9,860	G5	Peekskill 250	E3	Shawano 7,598	J6	Waupun 8,207	J8	Long (lake)	J2
Merrillville 553	E7	Pell Lake 2,018	K10	Sheboygan 49,676	L8	Wausau 37,060	G6	Madeline (isl.)	E2
Merrimac 392	G9	Pembine 500	L4	Sheboygan Falls 5,823	L8	Wausaukee 656	K5	Manitowish (lake)	H9
Merton 1,199	K1	Pence 234	F3	Sheldon 268	D5	Wautoma 1,784	H7	Menominee (riv.)	L5
Middle Inlet 200	K5	Pensaukee 225	L6	Shell Lake 1,161	C4	Wauwatosa 49,366	L1	Menominee Ind. Res.	J5
Middleton 13,289	G9	Pepin 873	B7	Sherry 115	G6	Wauzeka 595	E9	Metonga (lake)	J2
Milana 200	C4	Peshigo 3,154	L5	Sherwood 837	K7	Wayside 140	L7	Michigan (isl.)	F4
Milan 153	F6	Pewaukee 4,941	K1	Shiocton 805	K7	Webster 823	K7	Michigan (lake)	M9
Milladore 314	F6	Phelps 950	H3	Shopiere 350	H10	West Allis 63,221	L1	Mississippi (riv.)	D10
Milltown 786	B4	Phillips 1,592	E4	Shorewood 14,116	M1	West Baraboo 1,021	G9	Montreal (riv.)	F8
Milton 4,434	B4	Pilot 150	J5	Shorewood Hills 1,680	G9	West Bend 23,916	K9	Moose (lake)	F3
Milwaukee 628,088	M1	Picklet 120	J8	Shullsburg 1,236	F10	Westboro 750	F5	Moose (lake)	J1
Mindoro 200	D7	Pigeon Falls 289	D7	Silver Lake 1,801	K10	Westby 1,866	E8	Nagawicka (lake)	F3
Mineral Point 2,428	F10	Pittsville 838	F7	Siren 863	B4	Westfield 1,125	H8	Namekagon (lake)	D3
Minocqua 950	G4	Plain 691	F9	Sister Bay 675	M5	West Milwaukee 3,973	L1	Namekagon (riv.)	C3
Minong 521	C3	Plainfield 839	G7	Slinger 2,340	K9	Weston 8,775	G6	North (lake)	J1
Mishicot 1,296	L7	Platteville 9,708	K1	Soldiers Grove 564	E9	West Salem 3,611	D8	Oak (isl.)	E2
Mondovi 2,491	C6	Pleasant Prairie 11,961	L10	Solon Springs 575	C3	Weyauwega 1,665	H7	Oconomowoc (lake)	H1
Monico 250	H4	Plover 8,176	G7	Somers 400	M3	Weyerhaeuser 283	D5	Oconto (riv.)	K5
Monona 8,637	H9	Port Clinton 534	B6	Somerset 1,065	A5	Wheeler 348	C5	Okauchee (lake)	J1
Monroe 10,241	G10	Plymouth 6,769	L8	South Milwaukee 20,858	M2	Whitelife Bay (North Shore P.O.) 14,272	M1	Owen (lake)	D3
Montello 1,329	H8	Potomac 200	H6	South Range 149	B2	Whitehall 1,494	D7	Pecatonica (riv.)	H11
Monterey 150	J1	Poglar 516	C2	South Wayne 478	G10	White Lake 304	J5	Pelican (lake)	H4
Montfort 676	E10	Portage 8,640	G8	Sparta 7,788	E8	Whitelake 12,636	J10	Peshigo (riv.)	K5
Monticello 1,140	G10	Port Edwards 1,848	G7	Spencer 1,757	F6	Whitling 1,838	H7	Petenwell (lake)	G7
Montreal 638	F3	Port Washington 9,338	L9	Spirit 400	F5	Wild Rose 676	H7	Pewaukee (lake)	K1
Morrisville 375	G9	Port Wing 290	D2	Spooner 2,484	B4	Williams Bay 2,108	J10	Phantom (lake)	J2
Moisane 3,820	G6	Potosi 654	E10	Springbrook 150	G9	Wilson 163	B6	Pine (lake)	J1
Mountain 250	K5	Potter 252	K7	Spring Green 1,283	C4	Wilton 478	F6	Porte des Morts (str.)	N5
Mount Calvary 558	K8	Potter 434	L5	Spring Valley 1,051	B6	Winchester 300	G3	Poygan (lake)	J7
Mount Hope 173	D10	Poyette 1,662	G9	Stangelville 150	E8	Wind Lake 3,748	K2	Puckaway (lake)	H5
Mount Horeb 4,182	G10	Poyippi 425	J7	Star Prairie 507	A5	Wind Point 1,941	M2	Red Cedar (riv.)	C8
Mount Sterling 217	D9	Prairie du Chien 5,659	D9	Steatsville 511	F5	Windsor 2,182	H9	Red Cliff Ind. Res.	E2
Mount Vernon 138	G10	Prairie du Sac 2,380	G9	Stauben 181	E9	Winnabago 1,433	J7	Rock (riv.)	J9
Mukwonago 4,457	J2	Prairie Farm 494	C5	Stevens Point 23,006	G7	Winnecoon 2,059	J7	Round (lake)	F4
Muscola 1,287	F9	Prairieville 571	F4	Stiles 300	L6	Winter 383	E4	Round (lake)	D3
Muskogee 16,813	K2	Prescott 3,243	A6	Stitzer 190	E10	Wiot 125	G10	Saint Croix (lake)	A6
Nashotah 567	J1	Presque Isle 251	G3	Stockbridge 579	K7	Wisconsin Dells 2,393	G8	Saint Croix (riv.)	A4
Navarino 140	J6	Princeton 1,458	H8	Stoddard 775	D8	Wisconsin Rapids 18,245	G7	Saint Croix Flowage (res.)	C3
Necedah 743	F7	Pulaski 2,500	K6	Stone Bank 390	J1	Withee 503	E6	Saint Louis (riv.)	A2
Neesah 23,219	J7	Racine 84,298	M3	Stone Lake 210	C4	Wittenberg 1,145	H6	Sand (isl.)	D2
Neillsville 2,680	E6	Radisson 237	D4	Stoughton 8,788	H10	Wotton 793	F8	Shawano (lake)	K6
Nekoosa 2,557	G7	Randolph 1,729	H8	Stratford 1,515	F6	Woodman 120	E9	Shell (lake)	C4
Nelson 388	C7	Random Lake 1,439	K8	Strum 949	D6	Woodruff 850	G4	Spider (lake)	D3
Nelsonville 171	H7	Raymond 300	L2	Sturgeon Bay 9,176	M6	Woodville 942	B6	Stockbridge Ind. Res.	J6
Neopit 615	J6	Readfield 200	J7	Sturtevant 3,803	M3	Wrightstown 1,282	K7	Stockton (isl.)	F2
Neosho 658	J9	Readstown 420	E9	Suamico 900	K6	Wyeville 154	F7	Sugar (riv.)	H10
Neshkoro 384	H8	Red Cliff 250	E2	Sullivan 432	H1	Wyocena 620	H9	Sugar-bush Hill (mt.)	J4
Newald 375	J4	Red Granite 1,009	H7	Summit Lake 250	H5	Superior 27,134	C9	Superior (lake)	F1
New Amsterdam 120	C8	Redsburg 5,834	G8	Sun Prairie 15,333	H9	Superior Village 481	B2	Thunder (lake)	H4
New Auburn 485	D5	Reeseville 673	J9	Superior 27,134	C9	Suring 628	K5	Tichigan (lake)	K2
New Berlin 33,592	K2	Rewey 220	F10	Sussex 5,039	K1	Taycheedah 350	K8	Timms Hill (mt.)	F5
Newburg 875	K9	Rice Lake 145	G6	Taylor 419	E7	Taylor 419	E7	Trempealeau (riv.)	C7
New Franken 150	L6	Rice Lake 7,998	F5	Tennison 378	E10	Theresa 771	K8	Trout (lake)	G3
New Glarus 1,899	G10	Richland Center 5,018	F9	Thompson 1,657	E6	Thiensville 3,301	K1	Washington (isl.)	M5
New Holstein 3,342	K8	Ridgeland 246	B5	Three Lakes 950	H4	Thorp 1,657	E6	Willow (res.)	F4
New Lisbon 1,491	F8	Rio 768	H9	Tichigan Lake 500	K2	Thursville 3,301	K1	Wind Lake	K2
New London 6,658	J7	Rio Creek 200	L6	Tigerton 815	H8	Thursville 3,301	K1	Winnabago (lake)	K7
New Richmond 5,106	A5							Wisconsin (riv.)	E9
Niagara 1,999	K3							Wolf (riv.)	J5
Nichols 254	M3							Yellow (lake)	B4
North Bay 246	K8							Yellow (riv.)	F7
North Bend 290	D7								
North Fond du Lac 4,282	J6								

## OTHER FEATURES

Apostle (isls.)	F2	Timms Hill (mt.)	K5
Apostle Islands Nat'l Lakeshore	E1	Trout (lake)	G3
Apple (riv.)	A5	Washington (isl.)	M5
Bad River Ind. Res.	E2	Willow (res.)	F4
Bardon (lake)	E2	Wind Lake	K2
Bea (isl.)	E1	Winnabago (lake)	K7
Beaver Dam (lake)	J9	Wisconsin (riv.)	E9
Beulah (lake)	J2	Wolf (riv.)	J5
Big Eau Claire (res.)	G6	Yellow (lake)	B4
Big Muskego (lake)	L2	Yellow (riv.)	F7



MILWAUKEE JOURNAL PHOTO

Milwaukee, Wisconsin's largest city, is an important lake port as well as a manufacturing and commercial center.

industries, such as the manufacture of plywood, veneer and pulp and paper. The hardwoods include ash, aspen, basswood, elm, maple, oak, yellow birch. The most abundant softwoods are balsam, fir, hemlock, pine, spruce, tamarack, and white cedar.

Among Wisconsin's valuable natural resources are its fish and wildlife. Game fish such as bass, muskellunge (the state fish), pickerel, pike, sturgeon and trout abound in the northern lakes and rivers. Game includes ducks, geese, partridges, quail, ruffed grouse, and woodcocks.

**Conservation.** Wisconsin has a well-developed conservation program. A state fish-stocking program each year provides millions of fish for streams, rivers, and lakes. The state has established bird refuge in Horicon Marsh and a bird and game farm at Poynette. Hunting and fishing seasons as well as bag limits are rigidly enforced.

Since the rapid depletion of the huge stands of pine, forest conservation has been an important part of the state program. Over 4 million acres (6 million hectares) are contained in two national forests and in state, county, school, and municipality forests. About 3,000 miles (4,830 kilometers) of three-row tree shelter belt now checks erosion in six central counties.

### The People

An important reform movement called Progressivism was started by Robert La Follette and other people of Wisconsin in the 1900's. The state became responsible for many reforms that were subsequently adopted by other states and the federal government. It was in Wisconsin where primary elections, regulation of public utilities, railroad safety, pensions for mothers and teachers, minimum-wage laws, and workmen's compensation were first introduced. The state's educational contributions include the first schools for training rural schoolteachers; the first vocational training schools; the first correspondence courses, first at the University of Wisconsin; and the kindergarten. The Republican party had its beginnings in Wisconsin, and the first hydroelectric plant was installed in the state. Wisconsin was the first to use the numeral system for mark-

ing highways, and passed the first law requiring safety belts in all new cars sold in the state. Wisconsin was also the first state to end the death penalty.

**Characteristics of the Population.** The first important permanent settlements were made after the War of 1812, when lead miners from Southern states migrated to southwestern Wisconsin. Soon afterward migration from the Northeastern states began, and by 1850 (two years after Wisconsin's admission to the Union), 96% of the state's residents were of Yankee origin. The rush of European immigration in the next few decades changed the state's population rapidly. By 1870, 50% of the population was foreign born. By 1910 the percentage had dropped to 22.1%.

Most of the late 19th century immigrants came from Germany, and Milwaukee became the leading American center of German culture. Other ranking immigrant groups were Norwegian, Canadian, Austrian, Irish, and Swedish. Early in the 20th century there was an influx from eastern Europe, particularly from Poland, and by 1930 this group made up 10% of the total state population. Wisconsin has every important national group known, and they have made crucial contributions to the state's history and culture.

Wisconsin is an important agricultural state, but its population is largely urban. The population has become concentrated in the industrialized eastern and southeastern sections of the state.

Nearly 40,000 Native Americans live in Wisconsin, many of them on five reservations in the northern part of the state. The largest tribes are the Chippewa and Menominee.

Church membership in Wisconsin is about evenly divided between Roman Catholics and Protestants. The principal Protestant groups are Lutheran, United Church of Christ, United Methodist, and United Presbyterian.

The Wisconsin vote since the Civil War has been divided between the Democratic and Republican tickets with only a slight leaning toward the Republican. Third parties have done well in the state. The Socialist party dominated Milwaukee's politics from 1900 to 1940, and during the 1920's there were Socialist members in both houses of the legislature. The Progressives' Philip





WISCONSIN DEPARTMENT OF AGRICULTURE

Wisconsin's dairy farms produce more than 40% of all U.S. cheese and a high proportion of other milk products.

F. La Follette served two terms as governor in the 1930's.

**Way of Life.** With its neighbors, Wisconsin shares general Midwestern views and culture. The variety of ethnic groups that settled in the state (such as the Germans in Milwaukee, the

Poles in Stevens Point, and the Cornish in the lead region) lent national characteristics to certain communities and areas, though few of these persist. Wisconsin has long enjoyed a reputation for good government and progressive legislation.

**Main Centers of Population.** Wisconsin's largest city is Milwaukee, an important port on the Great Lakes and an industrial center. Noted for two outstanding universities and its breweries, the city has a European atmosphere and is one of the leading centers of German-American culture in the nation.

The second-largest city is Madison, the state capital, where the main campus of the University of Wisconsin is located. Other important manufacturing and shipping centers are Racine, Kenosha, West Allis, and Green Bay, home of the state's popular Green Bay Packers football team. Nearly two thirds of the state's population live in urban areas.

#### RESIDENT POPULATION SINCE 1860

Year	Population	Year	Population
1860	775,881	1960	3,951,777
1880	1,315,497	1970	4,417,821
1900	2,069,042	1980	4,705,642
1920	2,632,067	1990	4,891,769
1940	3,137,587		

Gain, 1980-1990: 4% (U.S. gain, 9.8%) Density, 1990: 89.9 persons per sq mi of land area (U.S. density, 70.3).

#### URBAN-RURAL DISTRIBUTION

Year	Percent urban	Percent rural
1920	47.3 (U.S., 51.2)	52.7
1930	52.9 (U.S., 56.2)	47.1
1940	53.5 (U.S., 56.6)	46.5
1950	57.9 (U.S., 64.0)	42.1
1960	63.8 (U.S., 69.9)	36.2
1970	65.9 (U.S., 73.5)	34.1
1980	64.2 (U.S., 73.7)	35.8

#### LARGEST CENTERS OF POPULATION

City or metropolitan area	1990	1980	1970
Milwaukee	628,088	636,297	717,372
Metropolitan area	1,432,149	1,397,020	1,403,884
Madison	191,262	170,616	171,809
Metropolitan area	367,085	323,545	290,272
Green Bay	96,466	87,899	87,809
Metropolitan area	194,594	175,280	158,244
Racine	84,298	85,725	95,162
Metropolitan area	175,034	173,132	170,838
Kenosha	80,352	77,685	78,805
Appleton	65,695	58,913	56,377
Metropolitan area	315,121 <sup>1</sup>	291,369 <sup>1</sup>	276,948 <sup>2</sup>
West Allis	63,221	63,982	71,649
Waukesha	56,958	50,365	39,695
Eau Claire	56,856	51,509	44,619
Metropolitan area	137,543	130,932	114,936
Oshkosh	55,006	49,620	53,082
Janesville	52,133	51,071	46,426

<sup>1</sup>Appleton-Oshkosh-Neenah. <sup>2</sup>Appleton-Oshkosh.

### 3. The Economy

From 1840 until after the Civil War, Wisconsin was a leading wheat-producing state. After about 1870 the state gradually turned to diversified farming and dairying. Manufacturing began in the villages along Lake Michigan in territorial times, and Milwaukee was long the leading flour-milling center of the West. Because of the ease of transportation along the Great Lakes, commerce has long been of importance to Wisconsin. The state has been able to bring in raw materials to build up a thriving metals industry, and it now ranks high in the production of machinery and electrical and transportation equipment. An abundant water supply has made possible the development of papermaking as a leading industry in the valleys of the Fox, Wisconsin, and Chippewa rivers.

**Manufacturing.** Milwaukee and the southeastern portion of the state are the most heavily industrialized. Wisconsin's leading manufactures are nonelectric machinery including engines, turbines, farm machinery, power cranes, machine tools, and metalworking machinery; food products; metal products such as hardware, cutlery, and cans; transportation equipment, including automobiles, truck and bus bodies,

# PERSONAL INCOME IN WISCONSIN

Source	1960	1970	1980
	(Millions of dollars)		
Farms .....	450	676	1,329
Mining .....	23	27	57
Construction .....	425	796	1,646
Manufacturing .....	2,783	4,665	11,571
Transportation, communications, and public utilities .....	460	794	2,078
Wholesale and retail trade .....	1,252	2,165	5,033
Finance, insurance, and real estate .....	284	545	1,630
Services .....	715	1,648	4,894
Other Industries .....	18	38	112
Government .....	707	1,826	4,270
	(Dollars)		
Per capita personal income .....	2,192	3,774	9,348
Per capita income, U.S. ....	2,216	3,945	9,521

Source: U.S. Department of Commerce, *Survey of Current Business*.

ships, and boats; and paper products. Kenosha's automobile production is second only to Detroit's. The paper industry is centered in the cities along the Fox River and the Wisconsin River, including Green Bay, Rhinelander, Algoma, Marinette, Neenah, Oshkosh, Eau Claire, and Wausau. Other industries of importance are the manufacture of lumber and wood products, rubber and plastic products, electrical machinery, heating and plumbing equipment, leather and leather goods, and the brewing of beer, one of the state's oldest industries.

**Agriculture.** While the number of farms in Wisconsin has been declining since the 1920's, the size of the farms has become larger. The state has about 94,000 farms, averaging nearly 200 acres (81 hectares) in size. More than half of Wisconsin's farms specialize in dairying and



livestock. Along with the beef, hogs, and turkeys produced here, mink ranching is another important livestock industry.

The major field crop in Wisconsin is corn, raised mainly for livestock feed. The state ranks high in the production of green peas, beets, cabbage, corn, cranberries, and snap beans. Other

Abundant forests and hydroelectric power have contributed to the development of Wisconsin's paper industry.

ASSOCIATION OF COMMERCE, GREEN BAY, WIS.



crops are potatoes, hay, cherries, apples, strawberries, and lettuce.

**Dairying.** About 40% of the nation's cheese and 20% of its butter come from Wisconsin. Dairying is important but not the state's leading industry. Because of the value placed on its dairy products, the sale of margarine was prohibited in the state until the early 1960's. Other dairy products produced here are condensed milk, evaporated milk, dried milk, malted milk, and ice cream. Wisconsin has more cows producing more milk than any other state in the country. Dairy-processing plants are located throughout the state.

**Mining.** Sand and gravel are the most valuable minerals in Wisconsin, followed by granite, dolomite, zinc ore, and clay. Iron ore is mined mainly in Jackson county, but mining does not constitute a major industry in the state.

**Transportation.** The first railroad across the state was completed between Milwaukee and Prairie du Chien in 1857. About ten railroads provide freight service in the state, the most heavy use of which is in the industrialized southeastern part of the state. Railroad ferries cross Lake Michigan from several points along Wisconsin's shore, carrying passengers and automobiles.

Wisconsin has two important waterways for the transport of freight cargo. One is the Great Lakes-St. Lawrence Seaway System, linking the Midwest with the Atlantic Ocean, and the other is the Mississippi River. Milwaukee is a major Great Lakes port, but many oceangoing ships also dock at Green Bay, Kenosha, Manitowoc, Sheboygan, and Superior.

Wisconsin, the first state to adopt the number system for highway marking, has more than 100,000 miles (160,000 km) of roads. About 600 miles (965 km) are part of the interstate system, but even the secondary roads are well maintained in the prosperous farming regions.

Scheduled airline service was established in 1927. Wisconsin has about 300 airports.

#### 4. Government

**Constitution.** The constitution of the state of Wisconsin was adopted in 1848, following the defeat by the voters of a constitution in 1846 that allowed married women to hold property in their own names, exempted 40-acre (16-hectare) homesteads from forced sale, and forbade banks of issue. The women's property rights and homestead exemption clauses later became law. The 1848 constitution has served Wisconsin throughout its history as a state. It has been amended to allow, among other things, the nonpartisan election of certain judicial and state officers, the direct primary, and a state income tax. To amend the constitution, two consecutive legislatures must concur on the amendment, which then must be approved by popular referendum.

Every citizen 18 years of age or over and of sound mind may vote in Wisconsin if he has been a resident of the state for six months and of his election district for ten days.

Judicial officers, members of county boards, and city and village officers are elected on nonpartisan tickets in April. Other state and county officers are elected in regular elections in November of even-numbered years. All party candidates are nominated in the September open primaries. Wisconsin has 11 electoral votes and nine representatives in the House of Representatives.

#### GOVERNORS OF WISCONSIN

Territorial	
Henry Dodge	1836-1841
James Duane Doty	1841-1844
Nathaniel P. Tallmadge	1844-1845
Henry Dodge	1845-1848
State	
Nelson Dewey (Dem.)	1848-1852
Leonard J. Farwell (Whig)	1852-1854
William A. Barstow (Dem.)	1854-1856
Arthur MacArthur (acting)	1856
Coles Bashford (Rep.)	1856-1858
Alexander W. Randall (Rep.)	1858-1862
Louis P. Harvey (Rep.)	1862
Edward Salomon (Rep.)	1862-1864
James T. Lewis (Rep.)	1864-1866
Lucius Fairchild (Rep.)	1866-1872
Cadwallader C. Washburn (Rep.)	1872-1874
William R. Taylor (Dem.-Greenback)	1874-1876
Harrison Ludington (Rep.)	1876-1878
William E. Smith (Rep.)	1878-1882
Jeremiah M. Rusk (Rep.)	1882-1889
William D. Hoard (Rep.)	1889-1891
George W. Peck (Dem.)	1891-1895
William H. Upham (Rep.)	1895-1897
Edward Scofield (Rep.)	1897-1901
Robert M. La Follette, Sr. (Rep.)	1901-1906
James O. Davidson (Rep.)	1906-1911
Francis E. McGovern (Rep.)	1911-1915
Emanuel L. Philipp (Rep.)	1915-1921
John J. Blaine (Rep.)	1921-1927
Fred R. Zimmerman (Rep.)	1927-1929
Walter J. Kohler (Rep.)	1929-1931
Philip F. La Follette (Rep.)	1931-1933
Albert G. Schmedeman (Dem.)	1933-1935
Philip F. La Follette (Prog.)	1935-1939
Julius P. Heil (Rep.)	1939-1943
Walter S. Goodland (Rep.)	1943-1947
Oscar Rennebohm (Rep.)	1947-1951
Walter J. Kohler, Jr. (Rep.)	1951-1957
Vernon Thomson (Rep.)	1957-1959
Gaylord A. Nelson (Dem.)	1959-1963
John W. Reynolds (Dem.)	1963-1965
Warren P. Knowles (Rep.)	1965-1971
Patrick J. Lucey (Dem.)	1971-1977
Martin J. Schreiber (Dem.)	1977-1979
Lee Sherman Dreyfus (Rep.)	1979-1983
Anthony S. Earl (Dem.)	1983-1987
Tommy G. Thompson (Rep.)	1987-

**Structure of Government.** Executive power rests in a governor who, with the lieutenant governor, secretary of state, treasurer, attorney general, and state superintendent of public instruction, is elected every four years. There is no legal limit to the number of terms a governor may serve. With the expansion of state services in the 20th century, many administrative boards and agencies were created by law.

Wisconsin has a bicameral legislature. The 33 members of the Senate are elected to serve four-year terms. There are 99 assemblymen elected to two-year terms. The legislature meets regularly on the first Tuesday after January 15, and may be called in special session by the governor. The people of the state may legislate directly through the initiative and the referendum at the local level, and all elected officials are subject to recall by the district voters.

Wisconsin's judicial system is headed by a state supreme court of seven justices elected on a nonpartisan ballot for ten-year terms. The justice with the longest service in the court serves as chief justice. Other courts include appellate, circuit, and county courts. Judges in these courts are elected, also on a nonpartisan

#### GOVERNMENT HIGHLIGHTS

**Electoral Vote—11.** Representation in Congress—U. S. senators, 2; U. S. representatives, 9. State Legislature—Senate, 33 members, 4-year terms; Assembly, 99 members, 2-year terms. Governor—4-year term; may serve consecutive terms.

ballot, to six-year terms. The office of justice of the peace was abolished in 1966.

**Public Finance.** Individual and corporate income taxes produce almost 55% of all state-collected tax revenue. Motor-fuel taxes and licensing fees are used for highway construction and maintenance. Fees from hunting and fishing licenses are used for conservation programs. Other taxes include a general sales tax, inheritance and gift taxes, public-utility tax, general property tax, and a tax on cigarettes. Federal grants and programs provide another source of income for the state.

**Social Services.** Wisconsin operates Wisconsin General Hospital and the Diagnostic Center in Madison; three schools for retarded children, in Union Grove, Sparta, and Madison; a school for the deaf in Delavan; a number of county hospitals for the care of the mentally ill; and about 25 community mental-health clinics. The state penal system includes a state prison in Waupun, a prison for women in Taycheedah (Fond du Lac county), a reformatory in Green Bay, a school for boys near Wales, and a school for girls in Oregon.

## 5. Education and Culture

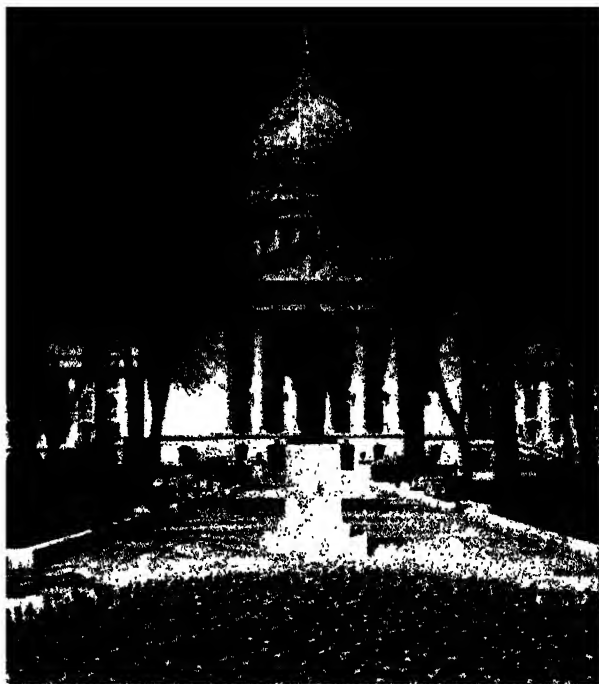
**Elementary and Secondary Education.** Wisconsin's first public elementary school was founded in Kenosha in 1845. Public high schools became common after 1875. Compulsory attendance between ages 7 and 14 was enacted after 1879, the upper age requirement being raised to 16 in 1949. In 1911 a system of part-time vocational education was established. The first kindergarten in the nation was opened in 1856 in Watertown by Mrs. Carl Schurz.

The office of state superintendent of public instruction was established by the constitution. Its control of public education is exercised mainly through the distribution of state aids, teacher certification, and enforcement of health, safety, and sanitation laws. The county superintendents of schools were replaced in 1964 by a state cooperative educational services committee. The committee was to plan for the establishment of area educational service agencies to handle the former superintendents' functions.

**Higher Education.** A state university was founded in Madison in 1849. The first of the state normal schools (now called state universities) opened in 1867 in Platteville. After that, eight more were established, and in 1955 the college in Milwaukee became the University of Wisconsin-Milwaukee. In 1911, Stout Institute for the training of industrial- and household-arts teachers was incorporated into the state system, and in 1955 the Platteville School of Mines became a state college. Twenty county colleges also train Wisconsin teachers.

Among Wisconsin's private colleges, Marquette University is the largest, and Carroll College at Waukesha is the oldest. Others include Lawrence University in Appleton, with its affiliated Conservatory of Music and Institute of Paper Chemistry; Ripon; Beloit; Carthage (in Kenosha); Milton College; and St. Norbert (in De Pere). Specialized schools include the Layton School of Art at Milwaukee and the Milwaukee School of Engineering.

**Libraries and Museums.** The State Law Library was founded in Madison in 1836. In 1895 a commission was established to develop library service throughout the state. The first legislative refer-



WOLLIN-FORRESTAL PHOTOGRAPHY

Wisconsin's State Capitol in Madison, built of white granite in 1917, is one of the most impressive in nation.

ence library in the nation was founded in Madison in 1901. There are two other outstanding libraries in Madison: that of the University of Wisconsin and that of the State Historical Society. The largest library in the state is the Public Library in Milwaukee.

The State Free Library Commission sends traveling libraries to all parts of the state, and the resources of the State Historical Society and University of Wisconsin libraries are available through interlibrary loan.

The Milwaukee Public Museum, operated by the city in connection with its public library, has a collection of prehistoric Indian tools, weapons, and other items. It is one of the nation's outstanding museums of natural science and history. The State Historical Society has a museum in addition to its library in Madison and also maintains the Stonefield Farm and Craft Museum in Baraboo.

Fine arts museums include the Wright Art Center at Beloit College, the Paine Art Center and Arboretum in Oshkosh, and the Milwaukee Art Center.

Museums of special interest include the Dard Hunter Paper Museum in Appleton, the Museum of Medical Progress in Prairie du Chien, and the Rhinelander Logging Museum, where the exhibits are housed in a replica of an old-time logging camp.

**Historical Societies.** Major work in state and local history is done by the State Historical Society and more than 90 local and county societies. The state society, founded in 1846, publishes books on Wisconsin, and the *Wisconsin Magazine of History*, a quarterly magazine for adults, as well as *Badger History*, a quarterly for elementary and high-school students. The society also maintains historic sites at Prairie du Chien, Greenbush, Cassville, and Baraboo.

**Other Cultural Institutions.** Much of Wisconsin's production in the arts has been of a regional nature. The Wisconsin Regional Writers' Asso-



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The Madison Civic Center contains a spacious cultural complex with an art gallery and a theater.

ciation, founded in 1948, and the Wisconsin Idea Theatre, established in 1953, have had a steady growth in membership. The Wisconsin Rural Art group, organized in 1940, holds regional and state exhibitions each year. In 1957, Milwaukee completed a war memorial that houses a fine arts gallery, and the Layton School of Art in that city erected a new lakefront building in 1957 for exhibition purposes. Wisconsin-born Frank Lloyd Wright's buildings for the Johnson Wax Company in Racine are outstanding examples of contemporary architecture.

**Communication.** The first newspaper in Wisconsin was the weekly *Green Bay Intelligencer* founded in 1833. The *Milwaukee Sentinel*, founded as a weekly in 1837, is the oldest existing newspaper, and the *Milwaukee Journal* has the largest circulation.

The state's weekly newspapers are banded together through the Wisconsin Press Association, the oldest state press association in the United States, having existed since 1853. Until World War I, Wisconsin also had a significant foreign-language press.

The first radio station in Wisconsin, station 9XM from the University of Wisconsin, began broadcasting in 1919. The oldest commercial station, WIBA, was licensed in 1925. The state's first television station, WTMJ-TV, started broadcasting from Milwaukee in 1947. Wisconsin has about 20 television stations and 225 radio stations.

## 6. Recreation and Places of Interest

**Resort and Other Recreational Areas.** The southern Wisconsin resort area includes Lakes Delavan and Geneva and the Oconomowoc chain. In the east-central region, the areas around Lakes Winnebago and Poygan are important. In the northern section, the lakes region of Oneida, Vilas, and Iron counties and of the northwestern part of the state are the principal attractions.

The Dells region of the Wisconsin River is one of the most attractive recreation and resort areas in the state. Here the river, cutting a channel through the soft sandstone, has carved rock formations into unusual shapes having names

such as Grand Piano, Devil's Elbow, and Fat Man's Misery. The Upper Dells are separated from the Lower Dells by a dam, and may be seen from footpaths or on boat tours.

Among other areas of unusual scenic beauty are the Door County Peninsula and Rib Mountain, at Wausau, one of the highest points (1,940 feet, or 591 meters) in the state.

There are two national forests in northern Wisconsin, Chequamegon and Nicolet, both with extensive recreational areas. There are more than 260 lakes in Nicolet, and 170 in Chequamegon. Important state parks are Nelson Dewey near Cassville; Pattison State Park, where Big Manitou Falls is located; Potawatomi on Sturgeon Bay; Wyalusing near Prairie du Chien; Peninsula State Park, one of the largest in the state, near Green Bay; Interstate Park at St. Croix Falls; Devils Lake State Park at Baraboo; Terry Andrae at Sheboygan, with its wide sandy beach on Lake Michigan; and Point Beach on Lake Michigan at Two Rivers.

Other pleasurable recreation areas are Apostle Islands National Lakeshore on Lake Superior; Ridges Sanctuary for the protection of the environment at Bailey's Harbor; Black River State Forest; Blue Mound State Park and Cave of the Mounds at Blue Mounds; Aqualand and Wildlife at Boulder Junction; Door County Peninsula; MacKenzie Environmental Center at Poynette; and at West Bend, Lizard Mound State Park, containing 31 Indian effigy mounds.

**Historic Sites and Monuments.** Historic sites include Old Wade House in Greenbush; Villa Louis in Prairie du Chien; Stonefield Farm and Craft Museum in Cassville; the nation's first kindergarten in Watertown; Fort Howard, Cotton House, and Tank Cottage in Green Bay; and Old Indian Agency House and Fort Winnebago Surgeon's Quarters in Portage. Other sites include Old World Wisconsin near Eagle, which consists of houses and other structures built by Wisconsin immigrants in the 1800's; First Capitol State Park near Belmont; and the schoolhouse in Ripon where the first meeting was held that gave birth to the Republican party in 1854.

**Other Places of Interest.** Places of interest in Wisconsin include House on a Rock near Dodgeville, which sits on top of a huge rock and features six fireplaces, seven pools, and many antiques; Little Norway near Mount Horeb, a village resembling one in Norway, with interesting Scandinavian-style houses and furnishings; Frank Lloyd Wright's home *Taliesin* and his architectural school at Spring Green; Octagon House at Watertown; Badger Mine and Museum at Shullsburg; Pendarvis in Mineral Point, a group of carefully restored Cornish homes; the National Bowling Hall of Fame and Museum in Milwaukee and the Green Bay Packers Hall of Fame containing the football team's trophies and mementos in Green Bay; Lac du Flambeau in the center of the 144-square mile (372-sq km) Chippewa Indian Reservation; Ozaukee County Pioneer Village at Cedarburg; and Granddaddy Bluff, towering over the city of La Crosse and offering a view of Wisconsin, Iowa, and Minnesota. Many of the lakes, including Michigan and Superior, have excursion boats. Municipal parks and zoos are found in the larger cities.

**Annual Events.** Many annual events take place during the winter, when ice and snow sports are at a peak. These include the three-day Snowmobile Derby at Eagle River, the Silver Skates



Racing Derby at Beloit, a ski-jumping tournament at Westby, and an Ice Fishing Jamboree at Presque Isle. Spring brings the Danish Kringle Fest to Racine in May, and the Syttende Mai Norwegian Festival to Stoughton and Westby. In the month of June there is the crowning of "Alice in Dairyland," which is held in a different Wisconsin city each year; the Fyr Bal Fest and Regatta at Ephraim; and the Heidi Festival in New Glarus.

Summer events include the Holland Festival in Cedar Grove, the Lumberjack World Championship in Hayward, the Volksfest and the Wilhelm Tell Pageant in New Glarus on Labor Day weekend, the cherry harvest in Door county, and the Musky Jamboree in Boulder Junction. Both the Wisconsin State Fair in Milwaukee and the Peninsula Music Festival at Fish Creek are held in August.

Indian events on the calendar include Chippewa powwows that take place twice weekly during the summer at Lac du Flambeau, and the



MILWAUKEE SENTINEL PHOTO

Favorite activities in Wisconsin include cross-country skiing, a sport that attracts many winter enthusiasts.

### FAMOUS WISCONSINITES

Allis, Edward Phelps (1824-1889), industrial pioneer.  
 Babcock, Stephen Moulton (1843-1931), agricultural chemist.  
 Bardeen, John (1908- ), physicist, winner of the 1956 Nobel Prize in physics.  
 Derleth, August William (1909-1971), author.  
 Dodge, Henry (1782-1867), soldier and statesman who fought in the Black Hawk War of 1832 and became the first governor of the Territory of Wisconsin.  
 Ferber, Edna (1887-1968), novelist, short-story writer, and playwright.  
 Gale, Zona (1874-1938), novelist who won the Pulitzer Prize for her play *Miss Lulu Bett* in 1921.  
 Houdini (1874-1926), magician and escape artist.  
 Kohler, Walter Jodok, Sr. (1875-1940), manufacturer and politician, planned and built model garden community. Governor, 1929-1931.  
 La Follette, Philip Fox (1897-1965), political leader, son of Robert M. La Follette, governor in 1931-1933 and 1935-1939; with his brother Robert M. La Follette, Jr., organizer of the Progressive Party in Wisconsin.  
 La Follette, Robert Marion (1855-1925), distinguished political figure, Progressive Republican governor, U. S. senator, and Independent presidential candidate in 1924.  
 La Follette, Robert Marion, Jr. (1895-1953), political leader elected to U. S. Senate to fill vacancy left by his father's death.  
 Leonard, William Ellery (1876-1944), poet.  
 Lunt, Alfred (1893-1977), actor.  
 MacArthur, Douglas (1880-1964), World War II military leader.  
 McCarthy, Joseph Raymond (1908-1957), U. S. senator.  
 Mears, Helen Farnsworth (1876-1916), sculptor.  
 Mitscher, Marc A. (1887-1947), commander of the carrier *Hornet* in World War II.  
 Murphy, William Parry (1892- ), Wisconsin-born physician and Nobel Prize winner.  
 Nieman, Lucius William (1857-1935), newspaperman who established the *Milwaukee Journal* in 1882.  
 Peck, George W. (1840-1916), governor and literary figure who wrote the *Peck's Bad Boy* series.  
 Schorer, Mark (1908-1977), novelist, biographer, and critic.  
 Schurz, Carl (1829-1906), political leader.  
 Sholes, Christopher L. (1819-1890), journalist and inventor of the typewriter.  
 Turner, Frederick J. (1861-1932), historian who won a Pulitzer Prize in history in 1933.  
 Twining, Nathan F. (1897-1982), Air Force general.  
 Van Hise, Charles Richard (1857-1918), geologist and president of University of Wisconsin 1879-1903.  
 Wilcox, Ella Wheeler (1850-1919), poet.  
 Wright, Frank Lloyd (1869-1959), foremost American architect.

Menominee Indian Pageant in Shawano in August. The World Dairy Exposition is held in Madison in October and the Holiday Folk Fair in Milwaukee in November.

### 7. History

Glaciation, or the lack of it, is responsible for Wisconsin's unusual topography. The ice scraped and carved the state's many lakes and left behind a valuable accumulation of glacial phenomena. About 1,500 years ago the area was inhabited by prehistoric Mound Builders who built burial mounds in the areas of Neenah and Baraboo. When the first explorers arrived, the chief tribes in the area were Menominee, Winnebago, Iowa, and Dakota.

**Exploration.** Frenchman Jean Nicolet made the first recorded visit to Wisconsin by a white man, landing at Green Bay in 1634 to cement trade relations between the Indians and the French. During the next 130 years the region was explored by Pierre Esprit Radisson and Medart Chouart de Groseilliers, Louis Jolliet (or Joliet), Jacques Marquette, Daniel Greysolon Duluth, Nicolas Perrot, and others. Jesuit missionaries labored from 1660 to Christianize the Winnebago, Chippewa, Menominee, Fox, Sauk, Potawatomi, and other tribes, but with little success. Posts at La Baye (later Green Bay) and La Pointe and on the Mississippi River conducted trade by which the countryside was practically denuded of beaver.

In 1763 control passed to the English, but the fur trade continued in the hands of French residents such as Charles de Langlade. Nominally, the United States gained control of the region in 1783, but the British did not withdraw until after the War of 1812. Occupation by the United States then became a fact with the erection in 1816 of Fort Howard at Green Bay and Fort Crawford at Prairie du Chien.

**Settlement.** After 1783 the Wisconsin region was successively part of the Northwest Territory (1783-1800) and the territories of Indiana (1800-1809), Illinois (1809-1818), and Michigan (1818-1836). Exploitation of the southwestern lead deposits began after 1822, and in 1827,

Indian title to the lead region was extinguished. At first many miners returned south each fall because of the severe winters (and were called "suckers," after the Mississippi River fish with similar migratory habits); others dug caves in the hillsides and there spent the winter months. These latter were jestingly called "badgers," and thus originated the popular nickname of the state and its people.

Indian treaties between 1829 and 1833 gave the whites all of present-day Wisconsin south of the Wisconsin River and east of the Fox. The last Indian stand against the whites in Wisconsin was the Black Hawk War in 1832. A land office opened in Mineral Point in 1834. When the Territory of Wisconsin was formed on July 3, 1836, there were within the boundaries of the present state about 12,000 inhabitants, most of whom lived in the lead region.

The territorial government formed at Belmont in the fall of 1836. Madison was chosen to be the permanent capital, and building began there in the winter of 1836-1837. Settlement of the southern third of Wisconsin progressed rapidly, and on May 29, 1848, the state constitution was approved and statehood was achieved.

Transportation posed an important problem for settlers of the new commonwealth. Steamboats and sailing vessels on the Mississippi and Great Lakes did little for the rich agricultural regions of the interior. Canals were projected but came to nothing. Plank roads were built in some places but proved only temporary expedients for transporting the growing flood of wheat to market. Railroads were the only solution, and the first line, between Milwaukee and Waukesha, was opened in February 1851 and extended to Prairie du Chien by 1857.

The Democratic party dominated the territorial and early state governments. The Republican party was officially formed in the state on July 1854 and won control of the state government in 1856. Except for three short intervals it remained the dominant party for more than 100 years.

Wisconsin contributed 91,379 soldiers to the Union armies during the Civil War and produced about 100 million bushels of wheat for the Northern forces. After the war the timber resources were thoroughly exploited, lumber production reaching a peak shortly before 1900. Wheat production fell sharply after 1870, and dairy farming was introduced and firmly established. Iron mining on the Gogebic Range in the north brought a flurry of speculative development in the 1880's.

**Modern Era.** Economically, the years after 1900 were marked by the emergence of the modern industrial and dairying state. With the end of the virgin forests, industry advanced to specialized fabrication of goods for a worldwide market, and Wisconsin took and maintained the national lead in dairying. Labor, whose principal organization in 1893 became the state federation of labor, began to gain in membership and power after the turn of the century.

Politically, the years after 1900 were marked by the triumph of the Progressive wing of the Republican party, led by Robert M. La Follette, who was governor in 1901-1906. Progressive measures such as the direct primary, ad valorem railroad taxation, workmen's compensation, and an industrial commission were passed under La Follette and his immediate successors. Stalwart

Republicans returned to power in 1915 and guided Wisconsin through World War I, when the state's industries produced ordnance, ships, and other manufactures for the war effort. Many of the 118,000 Wisconsin men who entered the armed forces served in the famous 32d Division.

From 1921 to 1939, save for two short periods, Wisconsin was again under Progressive domination. During the 1920's, to aid farmers, a department of markets was created and the campaign against bovine tuberculosis was pushed vigorously. Greater home rule was extended to cities, and the recall of public officials was provided for by constitutional amendment. Wisconsin progressivism found national expression in the 1924 presidential campaign of Sen. Robert M. La Follette, who, as an Independent candidate, received the support of 4.8 million voters.

In 1930 a La Follette son, Philip, became governor at age 33. He lost to a Democratic landslide in 1932 but was reelected in 1934 and 1936. He and his followers seceded from the Republican party in 1934 to form the Progressive party. During the 1930's, Wisconsin legislation improved the status of labor with the "Little Wagner Act" and the nation's first unemployment compensation law, and assisted farmers with measures for farm debt relief. The Wisconsin Agricultural Authority and the Wisconsin Development Authority were established. Republicans regained state offices in 1938 and were still holding them 20 years later, governors during this period being of the conservative mold.

During World War II, Wisconsin war plants turned out over \$12 billion worth of war matériel, and Wisconsin farmers produced record quantities of dairy products, fruits, vegetables, eggs, and poultry, in spite of the absence of over 300,000 young men and women who had entered the armed services. Another 132,000 served in the armed forces during the Korean conflict.

#### HISTORICAL HIGHLIGHTS

- 1634 The first of the French explorers, Jean Nicolet, landed on the Green Bay shore.
- 1673 Louis Joliet and Father Jacques Marquette discovered the Upper Mississippi.
- 1689 Nicolas Perrot claimed the region for France.
- 1701 First permanent settlement was established at Green Bay.
- 1763 England received the Wisconsin region from France after the French and Indian War.
- 1783 Wisconsin became part of the United States.
- 1832 Indian resistance ended in Wisconsin with the Black Hawk War.
- 1836 Congress created the Territory of Wisconsin.
- 1848 Wisconsin became the 30th state on May 29.
- 1851 Railroad track completed between Milwaukee and Waukesha.
- 1854 The Republican Party was founded at Ripon.
- 1872 The Wisconsin Dairymen's Association was organized by William D. Hoard and others.
- 1901 Robert M. La Follette, Sr., became governor, and the Progressive era began.
- 1903 The Wisconsin legislature passed the first law establishing primary elections.
- 1911 State legislature passed progressive legislation, including teachers' pensions and a commission to settle labor disputes.
- 1924 Senator Robert M. La Follette ran for U. S. president but was defeated.
- 1932 Wisconsin passed the first state unemployment compensation act.
- 1959 The St. Lawrence Seaway was opened.
- 1964 Wisconsin became the first state to have its legislative districts reapportioned by order of its supreme court.
- 1971 All state universities were united in a University of Wisconsin system.

The 1950's brought many difficult problems, such as a rapid rise in school population at all levels, increased auto traffic, the need for urban improvement, and a constant demand for greater revenue to pay the bills. It also brought television and the Milwaukee Braves baseball team, the 1957 world champions, and was marked by the rise to prominence of one of the most controversial figures in the state's political history, Sen. Joseph Raymond McCarthy. Wisconsin shared in the nationwide prosperity of the 1950's and experienced a boom in building, industry, and farm production, though farmers did not escape the cost-price squeeze that generally affected the agricultural segment of the nation's economy. Democrats put an end to the long period of Republican rule in the state house, electing Gaylord A. Nelson to the governorship in 1958 and reelecting him in 1960. Nelson was succeeded by another Democrat, John W. Reynolds, after the election of 1962. From the 1960's into the 1980's the Democrats alternated more or less regularly with the Republicans in the governor's office.

In the 1960's the St. Lawrence Seaway was bringing oceangoing cargo vessels to Wisconsin ports. Sports fans were cheering the success of the state's professional football team, the Green Bay Packers, but regretting the loss of the Milwaukee Braves baseball team to Atlanta, Ga. In 1970, however, Milwaukee got a new baseball team, the Brewers, formerly the Seattle Pilots. In government, the legislature approved a major reorganization of state agencies, a strong program to control water pollution, and revision of the state's primary system.

JAMES I. CLARK, *Author of*  
*"Life on Wisconsin's Lead-Mining Frontier"*

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**WISCONSIN, University of**, a coeducational institution of higher learning, controlled by the state of Wisconsin. The University of Wisconsin consists of 13 branches: Eau Claire, Green Bay, La Crosse, Madison, Milwaukee, Oshkosh, Parkside (at Kenosha), Platteville, River Falls, Stevens Point, Stout (at Menomonie), Superior, and Whitewater. All the branches grant bachelor's and master's degrees. The University of Wisconsin-Madison and the University of Wisconsin-Milwaukee also grant doctorates.

In addition to its degree-granting institutions, the University of Wisconsin includes the University of Wisconsin Center System, a complex of two-year lower-division units. These are located in Baraboo, Barron county, Fond du Lac, Fox Valley, Manitowoc, Marathon county, Marinette, Marshfield, Medford, Richland, Rock county, Sheboygan, Washington, and Waukesha. Center-system course credits leading to a degree may be transferred to any of the degree-granting branches of the university. Instruction also is offered through the University of Wisconsin extension program, provided at the branches of the university as well as at the various center-system campuses.

The University of Wisconsin system was created in 1971, when the University of Wisconsin in Madison was merged with state universities. The total enrollment of the system is about 150,000, of which some 8,700 are in the center system and extension program.

The University of Wisconsin-Madison is the oldest branch of the university. It was founded in 1848 as the University of Wisconsin. Instruction began in 1849, and its first baccalaureate was given in 1854. The central administrative offices of the entire university and of the center system are located here.

The Madison branch comprises the colleges of letters and science, agricultural and life sciences, and engineering and the schools of business, education, nursing, pharmacy, law, and medicine. Full-time enrollment is about 32,000 students.

The University of Wisconsin-Eau Claire was established as a normal school, with first instruction in 1916. It became a teachers college, granting baccalaureates, in 1927; a state college in 1951; and a state university in 1964. Full-time enrollment is about 9,000.

The University of Wisconsin-Green Bay was established in 1969. Full-time enrollment is about 2,200.

The University of Wisconsin-La Crosse was first a state normal school (1909) and later a state teachers college (1926), a state college (1951), and a state university (1964). Full-time enrollment is about 7,000.

The University of Wisconsin-Milwaukee, with a full-time enrollment of some 13,000, is the second largest of the university branches, after Madison. Established in 1955 by the merger of a state college and a university extension division, it offers instruction in schools of architecture, business administration, education, fine arts, nursing, social welfare, and library and information science and in colleges of letters and sciences and of engineering and applied science.

The University of Wisconsin-Oshkosh was established as a normal school (1871) and became a teachers college (1925), a state college (1949), and a state university (1964). It comprises the schools of letters and sciences, business, educa-

tion, and nursing, and a graduate school. Full-time enrollment is about 7,000.

*The University of Wisconsin-Parkside* was established in 1965. Full-time enrollment is about 2,500.

*The University of Wisconsin-Platteville* was chartered as a normal school in 1866 and became a teachers college in 1927 and a state college in 1951. In 1959 it merged with the Wisconsin Institute for Technology (established 1907) as the Wisconsin State College and Institute of Technology, after which, in 1964, it became a state university. Full-time enrollment is about 4,000.

*The University of Wisconsin-River Falls* was chartered as a normal school (1874) and became a teachers college (1926), a state college (1951), and a state university (1964). It offers courses in colleges of arts and sciences, agriculture, and education. Full-time enrollment is approximately 4,000.

*The University of Wisconsin-Stevens Point* was established as a normal school in 1894. It became the Central State Teachers College in 1926, Wisconsin State College in 1951, and Wisconsin State University-Stevens Point in 1963. Its components are the colleges of letters and science, fine arts, natural resources, and professional studies. Full-time enrollment is about 7,000.

*The University of Wisconsin-Stout* was established as the Stout Manual Training and Domestic Science School in 1891 and incorporated as the Stout Institute in 1908. It became a state college in 1955 and a state university in 1964. Full-time enrollment is about 5,500.

*The University of Wisconsin-Superior* was a normal school (1893), teachers college (1925), state college (1952), and state university (1964). Full-time enrollment is about 2,000.

*The University of Wisconsin-Whitewater*, with colleges of letters and sciences, arts, business and economics, and education and a school of graduate studies, was established as a normal school in 1868. It became a teachers college in 1925, a state college in 1951, and a state university in 1964. It comprises the colleges of letters and science, arts, business and economics, and education. Full-time enrollment is approximately 7,000.

**WISCONSIN RIVER**, a river in Wisconsin, originating in Lac Vieux Desert on the Wisconsin-Michigan border. The river bisects the state, following a generally southerly course to Portage, the head of navigation, and then flowing southwestward to a point about 3 miles (5 km) below Prairie du Chien, where it enters the Mississippi River. Shifting sandbars are encountered in some parts of the river, which is navigable for about one third of its 625-mile (1,006-km) length. It was once an important artery of commerce. There are several dams and hydroelectric installations along its course. Among its many waterfalls are the Dells of Wisconsin and Grandfather Bull Falls. A canal at Portage, joining the Wisconsin with the Fox River, is no longer in use. The river is lined at several points with bluffs rising to 400 feet (122 meters).

**WISDOM LITERATURE.** See *BIBLE—Growth of the Old Testament Literature* (Types of Literature in the Old Testament); *WISDOM OF SOLOMON, THE*.

**WISDOM OF SOLOMON, The** (in Douay Bible, *BOOK OF WISDOM*), a book regarded by Protestants and Jews as apocryphal, but accepted by Roman Catholics as part of the Old Testament canon by virtue of its inclusion in the Latin Vulgate and its recognition by the Council of Trent (1545–1563). It purports to be the work of Solomon, the author referring to himself as a king, son of a king, judge, builder of the Temple, and recipient of wisdom and wealth from God, but its apparent use of certain Old Testament books in Greek, the presence of Greek thought and late Jewish elements, and the historical situation reflected in it lead to the supposition that it was composed in Greek by an Alexandrian Jew about a century before Christ. Its general purpose appears to be to encourage Jews to be true to their faith in a hostile environment in which temptations to idolatry and skeptical materialism are strong. In its poetic style and in content it has much in common with other "wisdom" literature, such as Proverbs, Job, Sirach (Ecclesiasticus), and certain of the Psalms.

The book falls into three main sections: (1) the diverse destinies of the godly and the ungodly (1 to 6:8), the former of whom may expect rewards and immortality, consisting of deliverance of the soul from the body, while the latter may expect punishment and extinction; (2) the praise of wisdom (6:9 to 9), co-worker with God and a divine gift and guide to the righteous; and (3) wisdom at work in Israelite history (10 to 19), a guide to the nation's leaders. Included in the last is an expansive account of the Exodus (16 to 19) and a long digression on the folly of idolatry (15 to 16), which leads to all kinds of evils.

While the writing doubtless exerted an influence in certain Jewish circles (an elaboration of similar viewpoints is found in Philo of Alexandria), its main usage was among early Christians, of whose Greek Bible it was a part. Affinities are found in the Pauline writings, in the Gospel of John, and in the Epistles to the Hebrews and of James. Many Christian writers knew and used it. It ranks as one of the most attractive and influential apocryphal books.

ALLEN WIKGREN, *The University of Chicago*

**WISE, Henry Alexander** (1806–1876), American political leader. He was born in Drummondstown, Va., on Dec. 3, 1806, and died in Richmond, Va., on Sept. 12, 1876. He graduated from Washington (now Washington and Jefferson) College in Pennsylvania in 1825, was admitted to the bar in 1828, and from 1830 practiced in Accomack county. In 1832 he was elected to Congress as a Jacksonian Democrat and remained in the House until 1844. He soon split with Andrew Jackson on the Bank of the United States issue, however, and from 1836 to 1840 ran as a Whig. Wise helped to secure the Whig vice presidential nomination for John Tyler in 1840, and when Tyler became president, Wise remained his close adviser. In 1844, Tyler named him minister to Brazil, where he served for three years.

An ardent defender of slavery and states' rights, Wise had meanwhile returned to the Democratic fold, and in 1855 he was elected governor of Virginia in a heated campaign against the Know-Nothing Party. He remained in office until 1860 and signed the death warrant of the abolitionist John Brown in 1859. In 1861 he at first advocated that Virginia remain in the Union but soon acceded to the prevailing secessionist sentiment



and became a strong supporter of the Confederacy. Although without military experience, he volunteered for service in the Confederate Army and in May 1861 was made a brigadier general. He was active in recruiting in western Virginia and also served on Roanoke Island, N.C., where one of his sons was killed. After further active service in South Carolina and Virginia, he was promoted major general three days before Robert E. Lee's surrender in 1865. At the end of the war he retired to private law practice in Richmond. He published *Seven Decades of the Union* (1872), a work dealing mainly with the life and administration of President Tyler. Hot tempered and vehement in speech, a highly effective campaigner and orator, he was one of the most colorful political leaders of the Old South.

**WISE, Isaac Mayer** (original surname WEIS), Bohemian-American rabbi, founder of Reform Judaism in the United States: b. Steingrub, Bohemia, March 29, 1819; d. Cincinnati, Ohio, March 26, 1900. He went to the United States in 1846 and served as rabbi first in Albany, N.Y., and then (from 1854) in Cincinnati, Ohio. There he began to make changes in the synagogue services, introducing organ music and prayers in English, and developing his congregation into a leading Reform temple. In 1854, also, he founded and became editor of the English-Jewish weekly, the *Israelite* (later *American Israelite*), which he soon supplemented with the German-Jewish weekly *Die Deborah*. Wise's ideal was to unite in Reform Judaism the best of the Jewish tradition with the best of modern Western culture. In 1855 he attempted to found a Reform Jewish rabbinical seminary, which did not succeed; in the same year he called a conference of rabbis in Cleveland to organize the Reform congregations of the United States into a countrywide movement; and in 1857 he published a Reform Jewish prayer book, *Minhag America*, in English and German editions.

In two subsequent conferences (1869 and 1871) Wise began to plan, and in 1873 succeeded in organizing, the Union of American Hebrew Congregations, which has continued ever since as the only organization of Reform Jewish communities in the United States. Wise succeeded in realizing his earlier plan, also, by founding (1875) in Cincinnati the Hebrew Union College, the Reform Jewish rabbinical seminary of the United States, of which he was the first president. His last great organizational achievement was the establishment (1889) of the Central Conference of American Rabbis, uniting all the Reform rabbis in the country. His *Selected Writings* (1900) and *Reminiscences* (1901) were edited by David Philipson.

RAPHAEL PATAI,  
*Director of Research, Theodor Herzl Institute,  
New York City.*

**WISE, John**, American aeronaut: b. Lancaster, Pa., Feb. 24, 1808; d. probably in Lake Michigan, Sept. 29, 1879. He made his first ascent in a balloon of his own design in Philadelphia, Pa., on May 2, 1835. More interested in the scientific aspects of balloon flight than in adventure or excitement, he made aeronautical and meteorological observations that proved of great value. In 1859 he carried mail by air for the first time in a flight from St. Louis, Mo., to Henderson, N.Y. (the destination had been New York City), with

three passengers. Wise volunteered in the Civil War but resigned from the Army after several disastrous flights. After he failed to get money for the purpose from Congress, the *New York Daily Illustrated Graphic* agreed in 1873 to finance construction of a large balloon to fly the Atlantic, but Wise withdrew from the flight after disagreement with the backers. On Sept. 28, 1879, at the age of 71, accompanied by a passenger, he ascended from St. Louis in the *Pathfinder*, intending to remain aloft as long as the gas lasted. The balloon was last seen the following day a few miles south of Lake Michigan and it is presumed that the balloon fell into the lake and that Wise perished there. Wise's body was never found. During his career he made 462 ascents. He published *A System of Aeronautics* (1850) and *Through the Air* (1873).

ELIZABETH B. BROWN.

**WISE, John**, American Congregational clergyman: b. Roxbury, Mass., bap. Aug. 15, 1652; d. Ipswich, April 8, 1725. He graduated from Harvard College (1673) and in 1680 accepted a call to the Chebacco Church in Ipswich, where he remained until his death. A militant champion of the rights of the colonists, he was deprived of his ministry for a short time in 1687 for leading the town in revolt against a tax imposed by Gov. Edmund Andros. In 1689 he represented Ipswich at the convention in Boston to reorganize the colonial government and in the same year was chaplain of the unsuccessful expedition against Quebec.

Wise's ideas of democracy in church and state had considerable influence on the political theorists of the Revolutionary period. In November 1705 Increase Mather published a pamphlet proposing a presbyterian form of government for the New England churches, which Wise opposed. His answer, *The Churches Quarrel Espoused* (1710), was largely instrumental in defeating the project. In 1717 he wrote *A Vindication of the Government of New-England Churches*, detailing his ideas about civil and ecclesiastical government, several passages of which are paraphrased in the Declaration of Independence. The two pamphlets, reprinted in 1772 and again in 1860, are remarkable for their brilliance of style as well as their democratic spirit.

**WISE, Stephen Samuel**, American rabbi and Zionist leader: b. Budapest, Hungary, March 17, 1874; d. New York, N.Y., April 19, 1949. The son of a rabbi, Aaron Wise (originally Weiss), he was taken to the United States as a child of one, studied at Columbia University (B.A., 1892; Ph.D., 1901), and received private training in rabbinics. From 1893 to 1900 he served as rabbi at the Madison Avenue Synagogue in New York City and then at a synagogue in Portland, Ore. In 1906 he was invited to the pulpit of Temple Emanu-El in New York City, the most influential Reform congregation in the United States; but, unable to accept any limitation on his freedom of utterance, he founded instead (1907) the Free Synagogue of New York, of which he remained rabbi until his death. Wise's oratorical brilliance and dynamic personality attracted large audiences to his sermons, which he frequently preached at Carnegie Hall on Sunday mornings. Generally these sermons were devoted to discussions of timely problems of American and Jewish life.



An outstanding Zionist leader from his early years, Wise was one of the founders (1898) of the Federation of American Zionists (later renamed the Zionist Organization of America), served as its president (1936-1938), and influenced many social and political leaders, among them President Woodrow Wilson, toward a sympathetic understanding of Zionism. He also took a deep interest in the social issues of his day, attacking injustices in the steel industry, championing a shorter factory work week for women, and fighting exploitation in the needle trades. His devotion to democratic ideals and practices induced him to found (1917) the American Jewish Congress, which he represented at the Versailles Peace Conference and served as president (1925-1929, 1935-1949). He also established (1922), in New York City, the Jewish Institute of Religion (united with the Hebrew Union College in 1950) for the non-sectarian and liberal training of rabbis. Recognizing the need for a united, worldwide organization to represent Jewish rights and interests, Wise founded the World Jewish Congress (1936), served as its president for the rest of his life, and as such became a world leader in the fight against Hitlerism. He was the author of *The Improvement of the Moral Qualities* (1902); *How to Face Life* (1917); *Child Versus Parent* (1922); *The Great Betrayal*, with Jacob De Haas (1930), on Britain's role in mandatory Palestine; and the autobiography *Challenging Years* (1949). In addition, a collection of his sermons were published in a 10-volume series, *The Free Synagogue Pulpit*.

RAPHAEL PATAI,

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New York City.

**WISE, Thomas James**, English bibliographer, book collector, and forger: b. Gravesend, England, Oct. 7, 1859; d. London, May 13, 1937. While employed by a London firm of essential oil merchants, of which he eventually became a partner, he began to collect and deal in manuscripts, books, and pamphlets by English writers. In 1912 he retired from business, and thereafter devoted his entire time to collecting books and making bibliographies. He published catalogues and bibliographies of Percy Bysshe Shelley, Alfred Tennyson, Algernon Swinburne, Samuel Taylor Coleridge, William Wordsworth, Robert Browning, Charlotte and Emily Brontë, Joseph Conrad, and many other outstanding writers. His own collection of rare editions, an unusually valuable one known as the Ashley Library, was acquired by the British Museum after his death in 1937. Some three years earlier, however, John Carter and Graham Pollard had published *An Enquiry into the Nature of Certain Nineteenth Century Pamphlets*, which proved that some of the works which Wise had sold to other collectors were forgeries; in later years, as other books he had handled were put on the market, other forgeries were uncovered. In the perpetration of these frauds, Wise seems to have been motivated chiefly by a desire for money. He used these funds to purchase books and manuscripts with which to improve his own library.

**WISE MEN FROM THE EAST**, in New Testament history, the three Magi (q.v.) who, according to the Gospel of Matthew (2:1-12), followed the guiding star to Bethlehem to render homage to

the newborn King of the Jews, bringing him gold, frankincense, and myrrh. A legend, which can be traced back to the 2d century, calls them kings, and later times distinguished them as Melchior, Caspar or Caspar, and Balthasar. They are honored at the Feast of the Epiphany. Empress Helena is said to have taken their bones to Constantinople, whence they were transported to Milan, and, eventually, to the cathedral at Cologne. They are sometimes referred to as the Three Kings of Cologne. In paintings representing the Adoration of the Magi, the youngest of the kings is usually portrayed as a Moor.

**WISEMAN**, wîz'mən, **Nicholas Patrick Stephen**, English Roman Catholic prelate: b. Seville, Spain, of Anglo-Irish parentage, Aug. 2, 1802; d. London, England, Feb. 15, 1865. While attending St. Cuthbert's College at Ushaw, near Durham (1810-1818), he decided to become a priest, and in 1818 went to Rome to study at the recently revived English College. There he specialized in Oriental languages, although he also attained distinction in natural sciences and dogmatic and scholastic theology, receiving his doctorate in divinity in 1824. The following year he was ordained a priest, and in 1828 he was appointed professor of Hebrew and Syro-Chaldaic at the University of Rome. In the same year, the publication of his *Horae Syriacae*, interpreting Syrian texts, firmly established his reputation as a scholar.

From 1828 to 1840 Wiseman served as rector of the English College. A man of wide learning and a gifted speaker, he soon began to devote his energies to a revival of Catholicism in England, and found a wide audience for the lectures he delivered there in 1835-1836 (published in 1836 as *Lectures on the Roman Catholic Church*). In 1836, with Daniel O'Connell and Michael Quin, he founded the *Dublin Review*. Consecrated titular bishop of Melipotamus in 1840, he was assigned to the Central District of England; in 1849 he became vicar apostolic of the London District. In 1850 he was created a cardinal and appointed archbishop of Westminster. He had already had considerable influence on the Oxford Movement (q.v.), and as archbishop he did much to aid the cause. The indignation aroused among English Protestants by the papal establishment in England of a hierarchy with territorial titles was allayed by his conciliatory pamphlet, *An Appeal to the Reason and Good Feeling of the English People on the Subject of the Catholic Hierarchy* (1850). Among Wiseman's other published writings are *Twelve Lectures on the Connexion Between Science and Revealed Religion* (1836); *Fabiola*, a popular novel dealing with the early Christian church (1854); *Recollections of the Last Four Popes and of Rome in Their Times* (1858); and *Points of Contact Between Science and Art* (1863).

**WISENT**. See **BISON**.

**WISHART**, wish'art, **George**, Scottish reformer and martyr: b. ?1513; d. St. Andrews, Scotland, March 1, 1546. He was probably born at Pitarrow, near Montrose, and educated at King's College, Aberdeen. While a schoolmaster at Montrose, he was accused of heresy for teaching the Greek New Testament, and in 1538 left for England, only to incur a similar charge at Bristol in the following year. Between 1539 or 1540 and

1543 he traveled on the Continent, probably in Germany and Switzerland, and then became a member of Corpus Christi College at Cambridge. Returning to Scotland in 1544, he embarked on a preaching tour that took him to Montrose, Ayre, Kyle, Dundee, Perth, Leith, and Edinburgh. His eloquent advocacy of the Reformation had great influence on John Knox, who became his intimate friend. In 1545, at the instigation of Patrick Hepburn, 3d earl of Bothwell, he was arrested at Ormiston; he had refused to allow Knox to share this risk with him. Tried for heresy by a convocation of bishops and other clergy under David Cardinal Beaton at St. Andrews in February 1546, he was condemned to death and burned at the stake.

**WISHAW.** See MOTHERWELL AND WISHAW.

**WISHBONE BUSH**, wīsh'bōn bōōsh, a colloquial name sometimes used for the plant *Mirabilis laevis*, and the closely related *M. Bigelovii*, in the four-o'clock family, Nyctaginaceae, because of the rather regularly forked branches, which suggest a wishbone. *M. laevis* is a partially woody bush, a foot or somewhat more in height, with oval, more or less heart-shaped leaves and rose-purple flowers about half an inch in length. It is native to California and Lower California. *M. Bigelovii*, which is sometimes included in *M. laevis*, differs chiefly in having sticky-hairy leaves and pink or white flowers.

EDWIN B. MATZKE.

**WISHRAM**, wīsh'rām, a small tribe of American Indians of the Chinookan language family, most closely related to the Wasco Indians (q.v.). The name by which they are known is that of their main village and means a species of flea. They call themselves Tlakluit. The Wishram live along the north bank of the Columbia River, in Klickitat County, Washington, and subsist largely on salmon. Although they took part in the Yakima Treaty of 1855, they are not reservation Indians. In 1960 they numbered approximately 125 individuals.

FREDERICK J. DOCKSTADER.

**WISMAR**, vīs'mär, city, Germany, in Rostock District, situated on Wismar Bay on the Baltic Sea, 35 miles east of Lübeck. It is a fishing and shipbuilding center; industries include sugar refining, distilling, metalworking, and the manufacture of railroad cars and machinery. It has a number of residences and warehouses dating from the 15th century, together with several churches of the same period, including the Marienkirche (a reproduction of a church in Lübeck) and St. George's Church, well known for its wood carving and murals. Interesting also is the Fürstenhof, a 16th century princely court constructed in Italian Renaissance style. Wismar, first mentioned as a town in 1229, was the residence of the princes of Mecklenburg from 1256 to 1306 and was a member of the Hanseatic League. Under the Treaty of Westphalia at the end of the Thirty Years' War in 1648, it passed to Sweden; in 1803 it was pledged to Mecklenburg with the privilege of recall for 100 years, a right which Sweden renounced in 1903. Very heavily damaged in World War II, Wismar was occupied successively by British and Soviet troops, and after the war passed to East Germany (German Democratic Republic). Pop. (1960) 55,400.

**WISSLER**, wīs'lēr, Clark, American anthropologist: b. Wayne County, Ind., Sept. 18, 1870; d. New York, N.Y., Aug. 25, 1947. After teaching in rural schools in Indiana (1887-1892) and serving as a high school principal in Hagerstown, he entered Indiana University to secure an A.B. degree in 1897 and an A.M. in 1899; in 1901 he received a Ph.D. in psychology from Columbia University. His interest had centered in psychology and education; he had been James McKeen Cattell's assistant at Columbia, and he continued as instructor in pedagogy at New York University (1901-1902) and carried on laboratory investigations in individual differences in mental ability at Columbia (1901-1903). But he had also studied under the anthropologists Franz Boas and Livingston Farrand, and in 1902 he became assistant in ethnology at the American Museum of Natural History. He advanced to the post of acting curator in 1905 and curator in 1906, lectured in anthropology at Columbia (1905-1909), and from 1907 to 1942 was curator in the department of anthropology at the American Museum, becoming curator emeritus in 1942.

After accepting his appointment at the American Museum in 1902, Wissler completed a series of field studies of the Plains Indian tribes of North America (1902-1905). Thereafter, as administrator, he sponsored and guided many research projects not only in ethnology but in archaeology and physical anthropology. He was a perceptive and prolific writer. His book *The American Indian* (1917; 3d ed., 1938) for the first time brought together in genuinely scientific fashion the accumulated knowledge on the environment, culture, speech, prehistory, and physique of the natives of the Americas. Other books, such as *Man and Culture* (1923; rev. ed., 1938), *The Relation of Nature to Man in Aboriginal America* (1926), and *An Introduction to Social Anthropology* (1929), dealt with the conceptualization of culture and the fields of phenomena related to it. In these works, as in various monographs and many articles, his ability to simplify, synthesize, and interpret played an important part in the development of anthropological research and concepts.

Wissler also served as professor of anthropology at the Institute of Human Relations at Yale (1924-1940) and as dean of the scientific staff at the American Museum (1935-1942). From time to time, in various official positions, he actively participated in the work of the National Research Council, the National Park Service, the American Museum Association, and various other learned societies and professional organizations.

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**WISSMANN**, vīs'män, Hermann von, German army officer and explorer: b. Frankfurt an der Oder, Germany, Sept. 4, 1853; d. Weissenbach, Austria, June 15, 1905. Entering the German Army, he reached the rank of major by 1889. In 1880-1883, in the employ of the German African Association, he accompanied Paul Pogge on a west-east African expedition. Pogge went as far as Nyangwe in the Belgian Congo, while Wissmann continued alone to Zanzibar. On a second expedition, undertaken for Leopold II in 1884-1885, Wissmann explored the Kasai River. A third expedition in 1886-1887 took him from Lubutu on the Congo to Mozambique by way of

the Sankuru, Lake Nyasa, and the Zambezi. Appointed imperial German commissioner in 1889, he suppressed an Arab revolt in East Africa. He resigned his office in 1891, but returned to the area as governor of German East Africa (now Tanganyika) in 1895-1896. Wissmann published several books on his expeditions, including *Im innern Afrikas* (with others, 1888); *Unter deutscher Flagge quer durch Afrika* (1889); *Meine zweite Durchquerung Äquatorial-Afrikas* (1890); and *Afrika* (1895).

**WISTAR**, wîs'tûr, **Caspar**, American physician: b. Philadelphia, Pa., Sept. 13, 1761; d. there, Jan. 22, 1818. The grandson of the colonial glass manufacturer Caspar Wistar (1696-1752), he received his medical education at the University of the State of Pennsylvania (B.M., 1782) and at Edinburgh University in Scotland (M.D., 1786). While in Edinburgh he was twice president of a student organization, the Royal Medical Society, and assisted in organizing a natural history society. Returning to the United States in 1787, he practiced in Philadelphia. In 1789 he was appointed professor of chemistry at the medical school of the College of Philadelphia, and after that institution and the University of the State of Pennsylvania were united as the University of Pennsylvania in 1791, he became adjunct professor of anatomy, surgery, and midwifery at the combined school. From 1808 to 1810 he served as professor of anatomy and midwifery, and thereafter as professor of anatomy. His textbook, *A System of Anatomy for the Use of Students of Medicine* (2 vols., 1811-14), was the first such American work. He had a broad range of interests, including other sciences and the humanities, and was elected to the American Philosophical Society in 1787, succeeding Thomas Jefferson as its president (1815-1818). He opened his home once a week to members of the society and visiting scientists; these famous meetings, which continued after his death, were known as the Wistar parties. Thomas Nuttall named the wisteria for Wistar, and the Wistar Institute of Anatomy and Biology was founded in his honor in 1892 by his grandnephew, the penologist Isaac Jones Wistar (1827-1905).

**WISTARIA**. See **WISTERIA**.

**WISTER**, wîs'tûr, **Owen**, American novelist: b. Philadelphia, Pa., July 14, 1860; d. North Kingstown, R.I., July 21, 1938. The grandson of the actress Fanny Kemble, he was educated at Harvard University, from which he graduated in 1882, and then went to Paris to study music. Although he showed talent as a composer, he decided against a musical career and returned to the United States two years later. After studying law at Harvard, he was admitted to the Pennsylvania bar in 1889. Meanwhile, he had begun to spend his summers in the West, and he found the region of such interest that he began to write stories about it. Now wholly devoted to a literary career, he published the collections *Red Men and White* (1896); *Lin McLean* (1898); and *The Jimmyjohn Boss, and Other Stories* (1900). *The Virginian* (1902), his most celebrated novel, with its chivalrous cowboy hero and realistic Western setting, became the prototype of many stories and novels by other writers. A best seller, it was also popular in play and film versions. Wister's non-Western novels, such as *Philosophy* 4 (1903)

and *Lady Baltimore* (1906), were less successful, but he wrote well-received biographies of three presidents: *Ulysses S. Grant* (1900); *The Seven Ages of Washington* (1907); and *Roosevelt—The Story of a Friendship, 1880-1919* (1930). His collected works, *The Writings of Owen Wister*, were published in a series of 11 volumes in 1928.

**WISTERIA** or **WISTARIA**, wîs-tîr'ê-ə, a genus of woody, twining vines in the bean or pea family, Leguminosae. It is named for Caspar Wistar (q.v.), and includes nine species, two of North America and seven of eastern Asia. The species have odd-pinnate leaves of numerous leaflets and long, drooping, graceful racemes of bluish purple flowers, similar to those of the pea, that bloom before the leaves are fully expanded. A second, smaller set of flowers often appears later in the summer. *W. frutescens* and *W. macrostachya* are indigenous to the southern and central United States.



Wisteria (*Wisteria sinensis*) resting against a house wall. Inset shows close-up of flowers.

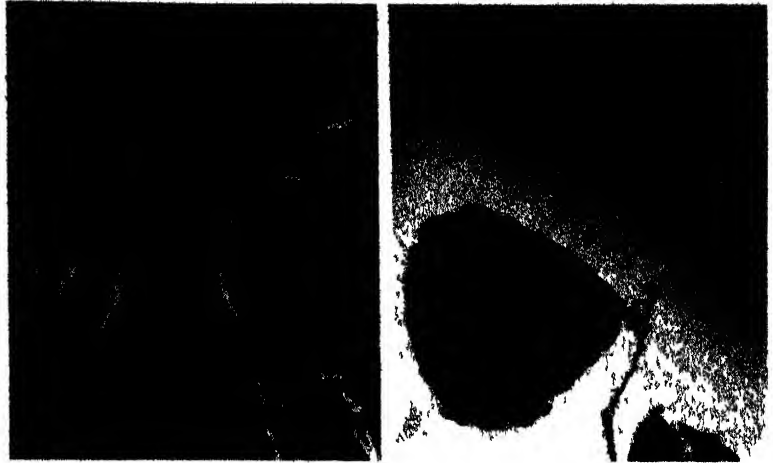
The most commonly grown species is *W. floribunda*, of Japan. It covers walls and trellises in spring with its attractive, fragrant racemes, which may attain a length of one and one-half feet; the leaves have 15 to 19 leaflets. White-flowered and double-flowered varieties also are cultivated. The Chinese wisteria, *W. sinensis*, also seen in cultivation, differs from its Japanese counterpart in having fewer (usually 11) leaflets, shorter racemes, and slightly larger individual flowers.

EDWIN B. MATZKE.

**WITCH HAZEL**, wîch hă'zəl, the colloquial name of any plant in the genus *Hamamelis* of the family Hamamelidaceae, or of the extract of *H. virginiana*. The genus includes five species, of which two are native to eastern and central North America and three to eastern Asia. *H. virginiana*, the common witch hazel of eastern North America, is a shrub or small tree with alternate, oval, wavy-margined leaves that turn pale yellow in

Witch hazel (*Hamamelis mollis*).  
Left: Flowers contain four separate strap-shaped petals. Right: Close-up view of leaf.

Roche



autumn. It blooms mostly in October and November. Its flowers have four yellow, strap-shaped petals, four fertile stamens and four staminodia, and a fruit which matures a year later. The two hard, shiny, black seeds are forcibly squeezed out of the woody capsule as it splits progressively from the top and are hurled for considerable distances. The witch hazels are unusual, especially among trees and shrubs, in their time of flowering. In contrast to *H. virginiana*, *H. vernalis*, of the south central United States, and *H. japonica* of Japan and *H. mollis* of China, Asiatic species planted as ornamentals, bloom from December or January to March or April.

Twigs and crotches of *H. virginiana* have been used as divining rods. Witch hazel extract, *aqua hamamelidis*, which is distilled from the bark and twigs, has been utilized in medicine. It is applied externally in alcoholic solution to soothe irritations, although its therapeutic properties are questionable.

EDWIN B. MATZKE.

**WITCH OF ENDOR**, ʼēn'dōr. According to Biblical history (I Samuel 28:7-25), King Saul, on the eve of the battle at Mount Gilboa, ordered his servants to find him a woman who "hath a familiar spirit" (King James Version) or "is a medium" (Revised Standard Version). Despite Saul's earlier order forbidding the practice of witchcraft (I Samuel 28:3), one such woman was still known to be living at Endor, near Nazareth, and he went to consult her. She invoked the spirit of Samuel, who prophesied the victory of the Philistines and Saul's death. After the warning, she prepared a meal for the king and gave him shelter for the night.

**WITCHCRAFT**, wīch'krāft, the practice of magic (q.v.) or sorcery. The word *witch* is derived from the Old English *wicce*, meaning "a female magician or sorceress," but although the terms "wizard" and "warlock" are available for male magicians, "witch" and "witchcraft" are generally applied to both sexes and their magical activities. Among many peoples accidents, sickness, death, and other untoward events have been thought to be caused by witches—individuals who had magical power which they used for evil purposes. Magic could, in primitive belief, be used for good; the practitioners of beneficent magic were often regarded as priests, using their power

for the common good; or a distinction was made between white or beneficent magic and black, malevolent magic. The Maori of New Zealand had schools which offered a rigorous training in magic. Most of the graduates used their magic for such purposes as assuring the success of voyages, protecting property, and curing sickness, but some would, for a fee, work magic to produce misfortune or death to an enemy of the client. In the Nilgiri Hills of southern India one of the most primitive tribes, the Kurumba, was noted for its powers of witchcraft, and members of other tribes in the area employed Kurumba witches to wreak vengeance on their enemies.

In Negro Africa, where witchcraft is widespread, the Lovedu (Lobedu) distinguish not only between good magicians and evil magicians or witches, but between day and night witches. The day witches, although they cause sickness and death, are not mysterious, for they use the herbs and drugs known to respectable medical practitioners of the tribe. Although they poison their victims, it is possible for a regular medicine man to identify the poison and supply an antidote. The night witches are mysterious in their procedure, and so are infinitely more terrifying. They are believed to have powers to ride invisibly through the air. They can cause disease, barrenness, and unproductive fields, among other calamities, and are particularly feared because no one knows how they operate. If witchcraft is suspected, a witch doctor is called in to divine the cause and set up countermagic. The day witches of the Lovedu operate knowingly. It is less certain that night witches exist except in the minds of the people who fear them.

In Europe witchcraft has a long history. Early Greek literature refers to witchcraft. Best known is the legend of Circe, who had the power to transform men to beasts. The Goetae (*goētes*), who voiced their incantations with wild shrieks and howls, were feared for their malevolent powers and sold love philters and poisons for money. Hecate, goddess of sorcery and witchcraft, haunted crossroads and graveyards and wandered by night, when dogs warned of her approach by barking. The English writer Montague Summers has suggested that the *goētes* and Hecate represent an indigenous religion partially displaced by more fashionable cults imported from the Middle East and elsewhere. In western Europe also witchcraft probably represents a sur-

## WITCHES' BROOM



This illustration from a 16th century German pamphlet shows three witches being burned at the stake in October 1535.

The Mansell Collection, London

vival of the pre-Christian religion of the area. The archaeologist Margaret Murray believes that the Satan of the European witch cult is related to the horned god pictured in cave paintings and rock carvings found in late prehistoric sites all the way from Spain to Russia. There is historic evidence that pagan religious rites were little affected by the Romans and were often practiced in Roman temples in Britain and Gaul. When Christianity was introduced into western Europe, many pre-Christian rites became associated with Christian ritual. As late as the 17th century it was said in France that "the greater part of the priests are witches." During the early centuries the church was tolerant of the popular religion, but by the 14th century it was sufficiently established to try to stamp out the pagan cults that flourished beside or even within the church.

While the church was attempting to eradicate popular pre-Christian rites, these rites were taking on a Christian coloration. The church held as dogma the opposition of good and evil. God was good; Satan, according to Dr. Murray's thesis, became identified with the pagan European horned god. The popular pagan religion seems to have accepted this antithesis and to have developed a ritual which was imitatively contrasted to the Christian faith. Infants were baptized at the quarterly sabbats (witches' sabbaths) held at Candlemas (February 2), May Day Eve (Walpurgis Night, April 30), Lammastide (August 1), and All Hallows Eve (Halloween, October 31); marriages were solemnized at the sabbats; and the religious rites included the distribution of bread and wine, in imitation of the Eucharist. The church equated the popular pagan deity with the principle of evil, the Devil, and popular rites with witchcraft. A Biblical exhortation, "Thou shalt not suffer a witch to live" (Exodus 22:18), was held to justify the witch-hunt that flourished for several centuries. The bishop of Coventry, who led a fertility dance in his churchyard in 1303, escaped trial because he was a bishop. In 1323 a lady was tried for worshipping a deity other than God but was let off because of her rank, but in 1431 Joan of Arc was burned at the stake for witchcraft, and in 1484 Pope Innocent VIII issued a bull against witches. It has been estimated that during the next three centuries 300,000 to 2,000,000 persons were executed as witches. It is difficult to know how many of the victims were followers of the old pagan religion, but many lost their lives in the general hysteria

simply because they were not liked in their communities, or how many genuinely believed themselves to be witches—to have magical powers to do evil. Certainly many innocent persons lost their lives, as in the Salem (Mass.) witch-hunt of 1692, which was begun by children who found diversion in the voodoo tales told by a West Indian slave woman and who, once they had started making accusations of witchcraft, found it easier to continue than to retract.

Among the practicing witches, one should distinguish between the simple women who dealt in herbs and charms to help their fellows as well as, on occasion, to injure them, and the ever-decreasing number of persons who clung to pagan religious rites. A belief in witchcraft persisted long after the witch hunt subsided. The Scottish poet Robert Burns described witches' sabbaths in his *Tam o' Shanter and Halloween*, and the witch-on-broomstick motif of modern Halloween decorations is a reminder of an earlier belief that witches flew through the air on Halloween. There may have been witches who believed themselves capable of such supernatural acts, for the drug plants they are recorded as using—opium poppy, mandrake, belladonna (deadly nightshade), and Indian hemp—are known to produce hallucinations and vascular excitement. The use of charms to cause illness or death has not completely died out: there is record of a man dying of witchcraft in New York in 1940. This last may seem strange to one living in a scientific world, but it is well established by observers of primitive societies where witchcraft prevails that people can die of witchcraft. The belief that one is a victim of witchcraft is psychologically as potent as actual magic could be. As for the great witch-hunt which shook Europe for several centuries, it has bequeathed to the English language the term "witch-hunt" in the meaning of "searching out and harassing proponents of an incompatible political philosophy."

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Anthropologist

Further Reading: Graubard, Mark, *Witchcraft and the Nature of Man* (Univ. Press of Am. 1985); Lerner, Christina, *Witchcraft and Religion: The Politics of Popular Belief* (Basil Blackwell 1986); Russell, Jeffrey B., *Witchcraft in the Middle Ages* (Cornell Univ. Press 1984).

**WITCHES' BROOM**, wĭch'əz brōom, a bunch of many upright or spreading, abnormally clustered branches or twigs that is formed on plants





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Witches' brooms on Mississippi hackberry.

as a result of attack by parasites. Witches' brooms are symptoms of infection. Although they can occur on nonwoody plants such as alfalfa, potato, and aster, they are most familiar on shrubs and trees, where some may exceed 10 feet in diameter. They may resemble a bush, a bird's nest, or a handleless broom attached to the host plant. Some may consist wholly or partially of dead branches; others, of living branches that can continue to grow for many years. The leaves they bear may be distorted; they may appear later in spring and drop earlier in fall than the normal leaves of the plant, and they may be yellowed. Flowers are rarely produced.

The parasites whose presence stimulates the formation of witches' brooms include fungi (on alder, birch, red cedar, and white cedar); bacteria (on pine); dwarf mistletoes (on pine, larch, and fir); viruses (on peach and black locust); and mites (on hackberry and willow). The stimulus responsible for certain types of witches' brooms is not well understood. Some witches' brooms may cause stunting or even death of the host plant, especially when many brooms develop on one individual. Other kinds do not appear to damage the host appreciably; however, they are unsightly and therefore may be objectionable, especially on street and ornamental trees. Control of witches' brooms on woody plants is best accomplished by removing and burning the brooms.

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**WITENAGEMOT** or **WITENAGEMOTE**, wīt'a-nā-gə-mōt (Old English *witan*, sages or councilors + *gemōt*, meeting), originally an assemblage of the freemen, at first of a tribe and later of the whole state, among the Anglo-Saxon conquerors of southern Britain. In time it evolved into an assembly of nobles, large landowners, and leading ecclesiastics. It met irregularly, and its composition fluctuated at the pleasure of the king. While its powers were largely advisory, the stature of its members gave it considerable influence. The Witenagemot elected the king in the event of a disputed succession; approved the regular succes-

sion if there was no dispute; served as the highest judicial court; and authorized laws, taxes, and other public measures. It passed out of existence at the Norman Conquest, and the later English Parliament was a separate growth and not a continuation of the Witenagemot.

See also **COURT, JUDICIAL—Anglican**.

**WITHER**, wīth'ūr, or **WITHERS**, wīth'ūrz, **George**, English poet and pamphleteer: b. Bentworth, Hampshire, England, June 11, 1588; d. London, May 2, 1667. Wither spent two years (1604–1606) at Magdalen College, Oxford, leaving without a degree. He entered Lincoln's Inn in 1615, but he seems to have been more interested in writing than in law. His first major work, 20 satires entitled *Abuses Stript and Whipt* (1613), although popular with readers, caused the government to imprison him. The Princess Elizabeth (daughter of James I), to whom he had addressed an epithalamium, secured his release after a few months. Wither then produced his most successful effort, *The Shepherd's Hunting* (1615), in imitation of William Browne's pastorals. The acclaim given this pastoral encouraged him to publish another, *Fidelia* (1615), which contains the famous lyric "Shall I Wasting in Despair?" *Wither's Motto* (1621), a mixture of pious reflections and satire against vice, again proved popular with readers but brought charges from the government, which were ultimately dropped. In 1622 he produced what was to be his last attempt at pure poetry, *Faire-Virtue, the Mistress of Philarete*.

Wither continued to turn out verse and prose until his death. Of his more than 100 separate published works, three fourths were produced after 1625. These writings, however, are different from the earlier poetry, for he had turned his talents to the service of the Puritan cause as a pamphleteer. He was a soldier, civil servant, humanist, and, above all, prophet and reformer. He came to believe that his mission in life was to prophesy and to preach "inner reform," a reflection of his strong belief in individualism. Despite the fact that he gained little recognition and even suffered imprisonment (1660–1663) for the sake of this unpopular cause, Wither continued to prophesy doom to a Britain which refused to reform. Most of his post-1625 writings touch on this subject. The best known are *Britain's Remembrancer* (1628), *Emblemes* (1635), and *Halelujah, or Britans Second Remembrancer* (1641). His last published work was a series of extracts from these prophetic writings, *Ecchoes from the Sixth Trumpet* (1666).

Wither was not a fanatical, self-righteous Puritan. He was learned; he had a sense of humility; he was moderate, even liberal in his toleration; and his individualism caused him to put his principles, particularly his strong belief that it was his mission in life to preach "inner reform," above party.

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**WITHERITE**, wīth'ūr-īt, the mineral form of barium carbonate, BaCO<sub>3</sub>, named for the English scientist William Withering (1741–1799). Although it is usually found in a massive condition, orthorhombic crystals sometimes occur. It has a hardness of 3 to 3.7, a specific gravity of 4.2 to 4.35, and a vitreous luster; its color is white, often

yellowish or grayish, and it has a white streak. Not a common mineral, it is often associated with galena and barite. Its main source is Cumberland and Northumberland in England, although it is also found in Lexington, Ky.; El Portal, Calif.; Rosiclare, Ill.; Freiburg, Germany; and elsewhere. It is used in refining sugar, making plate glass, and for adulterating white lead and zinc white.

**WITHERSPOON**, with'úr-spōon, **Herbert**, American singer: b. Buffalo, N.Y., July 21, 1873; d. New York, May 10, 1935. While a student at Yale University, from which he graduated in 1895, he decided to become a professional singer. He studied theory with Horatio Parker and Edward MacDowell, and then took voice lessons in New York, London, Paris, and Berlin. His operatic debut was made with the Castle Square Company in New York in 1898. For several years he devoted himself mainly to concert work, touring the United States with the Thomas and Pittsburgh orchestras, before joining the Metropolitan Opera House as first basso in 1908. He remained with the Metropolitan for eight years, specializing in Wagnerian roles. Thereafter he used his gifts in concert work and as a successful teacher. He published *Singing* (1925) and *36 Lessons in Singing for Teacher and Student* (1930). From 1925 to 1929 he was president of the Chicago Musical College, and in 1930-1931 served as director of the Chicago Civic Opera Company. He was director of the Cincinnati Conservatory of Music in 1932-1933, and then returned to New York City. In March 1935 it was announced that he would succeed Giulio Gatti-Casazza as director of the Metropolitan Opera House, but he died two months later.

**WITHERSPOON**, **John**, American Presbyterian clergyman, educator, and patriot: b. Yester, near Edinburgh, Scotland, Feb. 5, 1723; d. near Princeton, N.J., Nov. 15, 1794. He received his divinity degree from Edinburgh University in 1743. As pastor of Paisley (1757-1768) he became widely known as a leader of the conservative group of the Presbyterian Church. Accepting an invitation to become president of the College of New Jersey (now Princeton University) in 1768, he held that position until his death. An ardent advocate of the colonial cause, he represented New Jersey in the Continental Congress from 1776 to 1782, with some intermissions, and was the only clergyman to sign the Declaration of Independence. During the Revolution he served on numerous committees and performed many valuable functions, particularly in connection with foreign relations, finance, and securing supplies for the army. After the war he renewed his efforts to organize the Presbyterian Church in the United States and, in spite of the setbacks caused by the war, to realize the vast potentialities of Princeton College; during his administration many future leaders of the country were trained there, including James Madison, William Bradford, Philip Freneau, and Henry Lee.

Witherspoon's religious and political writings include *Ecclesiastical Characteristics* (1753); *A Serious Enquiry into the Nature and Effects of the Stage* (1757); *Essays on Important Subjects* (2 vols., 1765); and *Considerations on the Nature and Extent of the Legislative Authority of the British Parliament* (1774), for a while attributed to Benjamin Franklin. His collected works were published in 6 volumes (1804-1805).

**WITHHOLDING TAX**. See **INCOME TAX—United States**.

**WITMER**, wit'mûr, **Lightner**, American psychologist: b. Philadelphia, Pa., June 28, 1867; d. there, July 19, 1956. He was one of a group of brilliant young American students who went to the University of Leipzig for doctoral study in the field of experimental psychology under Wilhelm Wundt. After earning his doctorate in 1892, he became director of the laboratory for experimental psychology at the University of Pennsylvania. Here, in 1896, he opened a psychological clinic, the first of its kind anywhere, in which psychological techniques and principles were applied in child guidance. The laboratory and clinic were reorganized as a department of the university in 1909, and he served as director until his retirement in 1937. He also helped to establish clinics for the treatment of speech disorders, for vocational guidance, and for educational disabilities. In 1907 he founded the journal *Psychological Clinic*, which did much to establish clinical psychology as a new profession. Although he and his students developed many psychological tests and measures (especially of the performance or non-verbal type) to facilitate diagnoses of individuals in trouble, Witmer's interest was directed more to qualitative analyses than to mere quantitative scores based upon routine testing.

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**WITNESS**, wit'nəs, in law, a person called upon to give relevant testimony under oath, as in a court of justice, with respect to something he has seen, heard, or otherwise observed. It is generally held that a witness is competent to testify if he is of sufficient age and intellect to understand and communicate what he has observed and to appreciate the significance of an oath. A witness, either in a civil or criminal case, may be compelled to attend court when required by law. He is commonly summoned by a subpoena, and if he does not attend when properly called and lacks sufficient excuse for his absence, he may be punished for contempt by fine or imprisonment. In addition, he may be liable for damages suffered by the party who subpoenaed him. A witness is exempt from civil arrest while in attendance at court, but not from arrest on a criminal charge. He usually testifies orally in open court, but sometimes his testimony is taken in writing before a commissioner or some other legal official.

Formerly many objections against the competency of witnesses were allowed, but many of these have been removed by legislation. In the absence of statutes to the contrary, a wife is usually not a competent witness against her husband in either a civil or criminal case, or a husband against his wife. Generally a witness cannot be compelled to give evidence in which he may incriminate himself, and the accused in a criminal case cannot be called as a witness for the prosecution to give evidence against himself. In most jurisdictions, confidential communications between an attorney and his client or between a doctor and his patient are privileged, and the attorney or doctor cannot testify as to those communications unless the client or patient waives the privilege.

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**WITTEKIND**, vīt'-kīnt, or **WIDUKIND**, vē'dōō-kīnt, Saxon leader in the struggle with Charlemagne: d. about 807. He came of a noble Westphalian house and first appears at the head of the Saxon expedition in Westphalia in 774. Charlemagne's return from Lombardy drove him across the Weser. He took refuge in Jutland and renewed the revolt in 776, refusing, unlike many other Saxon leaders, to submit to the emperor at the Diet of Paderborn in 777. He returned during Charlemagne's absence in Spain, laid waste the Rhineland, and is believed to have surprised and annihilated the Frankish army at Süntel on the Weser in 782. The emperor retaliated by executing 4,500 Saxon prisoners, an act that aroused all Saxons to arms and for the first time united them behind a single leader in opposition to Charlemagne. Nevertheless, after heroic resistance, Wittekind was forced to submit (785) and to accept baptism in the imperial camp at Attigny in Champagne.

It is difficult to establish the facts of his later life; he became a great hero to the Saxons, and many conflicting legends have grown up about him. Charlemagne is believed to have made him duke of the Saxons, and he is said to have died in battle in 807 and to be buried in the parish church at Enger in Westphalia.

**WITTELSBACH**, vīt'əls-bākH, the name of a historically significant German family, one of the four dynasties (Habsburg, Hohenzollern, Wittelsbach, and Wettin) which were to shape Germany (representing respectively Austria, Brandenburg, Bavaria, and Saxony). The ancestral castle of Wittelsbach, near Aichach in Upper Bavaria, was destroyed in 1209; the spot is marked by a church and an obelisk.

Two Wittelsbacher were elected German emperors: Louis the Bavarian, who reigned as Emperor Louis IV from 1314 to 1347; and the Elector Charles, who reigned as Charles VII from 1742 to 1745. (See CHARLES VII, Holy Roman emperor; LOUIS—*Holy Roman Emperors*: Louis IV.) Another, Rupert (III), was German king from 1400 to 1410.

Collateral members of the house were margraves of Brandenburg in the 14th century, and kings of Sweden (Charles X Gustavus, Charles XI, and Charles XII) from the mid-17th to the early 18th century.

The first known Wittelsbacher was Margrave Liutpold, who took the title of duke of Bavaria and died in 907 near Pressburg while fighting against the Magyars. In the early 12th century, descendants of the Scheyern branch of the family moved to Wittelsbach and began to call themselves by that name. In 1115, Emperor Henry V recognized Count Otto V as count Palatinate in Bavaria. The latter's son, Otto VI, one of the most trusted adherents of Frederick I (Frederick Barbarossa), accompanied the German king on an Italian expedition and also rendered him valuable services in the Germanies.

When Henry the Lion, duke of Saxony and Bavaria, was placed under the imperial ban in 1180, Otto VI was invested as 1st duke of Bavaria (without Steiermark). The settlement of 1180 did away with the old tribal kingdoms, their places being taken by the territories of the "princes of the empire." Under the early Wittelsbachs, Bavaria increased in prosperity. Otto's descendants, with short interruptions, remained the rulers of Bavaria until the German revolution

of 1918. The story of the dynasty is closely associated with the history of Bavaria.

The possibility of Bavaria becoming the outstanding power in the Germanies (a goal later achieved by Prussia and the Hohenzollern family) was halted in 1255 when the duchy was split into two parts under two lines of the Wittelsbach family—the dukes of Bavaria (resident at Munich) and the counts of the Rhenish Palatinate (resident at Heidelberg). The history of Bavaria now became a melancholy chronicle of territorial divisions, family feuds, and petty quarrels, as the electoral dignity passed from one branch of the house to another. In 1329, Bavaria and the Palatinate were separated. In 1347, at the death of Louis IV, the Bavarian line lapsed into obscurity. In 1392 the duchy of Bavaria was separated into three parts—Ingolstadt, Landshut, and Munich. In 1504, Albert IV the Wise (1447–1508), defeated his cousin Rupert of the Palatinate and secured for himself succession to the united Bavarian dukedoms.

After the death of Albert the Wise, a partial division took place between his sons, William IV and Louis. On the death of the latter in 1545, William IV (r. 1508–1550) ruled over an again united Bavaria. William IV was loyal to the Catholic Church when almost every other secular prince of consequence became Protestant. As a reward the church granted him important influence in religious matters. The dukes of Bavaria were noted for their championing of Roman Catholicism against the Reformation, even though the Palatinate had espoused Protestantism.

Albert V (r. 1550–1579) and William V (r. 1579–1597), both excellent organizers and administrators, made Bavaria a prosperous country despite its lack of natural resources. Maximilian I (r. 1597–1651), who took an active part in the Thirty Years' War, recovered the Upper Palatinate. A compact and strong Bavaria was thus created that was able to play a role in the councils of Europe (see MAXIMILIAN I). The Wittelsbach policy remained in traditional opposition to the Habsburgs.

Maximilian III Joseph (r. 1745–1777) founded the Academy of Sciences in Munich. With his death the line of Bavarian electors became extinct. The new ruler of Bavaria was Charles Theodore, elector of the Rhenish Palatinate and duke of Jülich and Berg. Frederick II the Great supported the claims of the next heir, Duke Charles of Zweibrücken, against Austrian pretensions. Out of this conflict came the bloodless War of the Bavarian Succession, which ended on May 13, 1779, with the Treaty of Teschen. Austria was given the region of the Inn, with the town of Braunau (which later achieved notoriety as the birthplace of Adolf Hitler), but succession in the rest of the Bavarian dominions was guaranteed to Duke Charles.

Maximilian IV Joseph (r. 1799–1825) became King Maximilian I in 1806, to be followed in turn by Louis (Ger. Ludwig) I, Maximilian II, Louis II, Otto I, and Louis III. With the abdication of the last of these in 1918, the dynasty ended, the Bavarian monarchy was abolished, and Bavaria became a republic. See LOUIS, kings of modern Bavaria; MAXIMILIAN, kings of Bavaria; OTTO I, king of Bavaria.

See also *BAVARIA—History*.

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**WITTEN**, wīt'ən, city, Germany, in the State of North Rhine-Westphalia, situated on the Ruhr River, 10 miles southwest of Dortmund. It is a modern industrial city and steel-manufacturing center and has plants for the fabrication of glass and chemicals and the extraction of coal-tar products; it is also a repair center for the German federal railroads. Its few historic buildings include Castle Steinhausen; St. John's Church, remodeled in 1762; and the Museum of Natural History, which contains a notable geological collection. Witten received its charter as a city in 1825. It suffered considerable damage from bombings during World War II. After the war, it was included in the British Zone of Occupation and later in the German Federal Republic (West Germany). Pop. (1961) 96,500.

**WITTENBERG**, wīt'ən-bûrg, Ger. wīt'ən-berkh, city, Germany, situated in Saxony-Anhalt, on the Elbe River, 55 miles southwest of Berlin and 35 miles northeast of Leipzig. It is an East German rail center and industrial city with iron works, breweries, chemical plants, and numerous small enterprises manufacturing soap and various food products. There are important chemical works at Piesteritz, just to the west. Wittenberg is famous for its associations with the Reformation. The 15th century Schlosskirche, where Martin Luther and Melancthon are buried, still stands; on its door Luther nailed his 95 theses on Oct. 31, 1517; three years later, in the marketplace, he publicly burned the papal bull which threatened him with excommunication. His residence, built in 1502, was restored in 1844 and is now a museum exhibiting manuscripts pertaining to the Reformation. The first complete Lutheran Bible was published in Wittenberg in 1534. Melancthon's house still stands, as does that of Lucas Cranach the Elder, who was a burgomaster and established his school of painting here. The university, founded in 1502 by Frederick the Wise and absorbed by the University of Halle in 1817, included among its instructors Luther, Melancthon, Johann Bugenhagen, and Justus Jonas. Among other notable buildings are a 14th century church and the city hall, built in 1524.

First mentioned about 1180, Wittenberg received its city charter in 1293. From 1273 to 1422 it was the capital of the Ascanian dukes of Saxe-Wittenberg, who became electors of Saxony; it then passed to the house of Wettin. In 1547, in the Schmalkaldic War, it was captured by Charles V after the Battle of Mühlberg and was superseded by Dresden as the ducal residence. It was besieged and suffered further destruction during the Thirty Years' War (1618-1648) and the Seven Years' War (1756-1763), and in 1813 it was taken and fortified by Napoleon. In the following year it fell to Prussia. It came under Soviet domination in 1945 and after 1949 was included in the German Democratic Republic (East Germany). Pop. (1960) 46,000.

**WITTENBERG UNIVERSITY** (formerly WITTENBERG COLLEGE), institution of higher education located at Springfield, Ohio. Founded in 1845, it is supported and controlled by synods of the Lutheran Church in America. It consists of five units: the College of Arts and Sciences, the School of Professional Studies (including the School of Music), the Graduate Studies Division, Hamma Divinity School, and the School of Community Education. Women are admitted in all depart-

ments. Undergraduate courses lead to the degrees of bachelor of arts; bachelor of science; bachelor of fine arts; bachelor of music; and bachelor of science in education, business administration, medical technology, and religious education. Advanced degrees are bachelor of divinity and master of sacred theology, awarded by the Divinity School; and master of education, master of arts in sacred music, and master of religious education, awarded by the Graduate Studies Division. The library had 115,000 volumes in 1962. The college songs are *The Alma Mater* and *The Fight Song*. The college colors are cardinal and cream, and the team nickname is Tigers. There is an undergraduate registration of about 1,900, with a total of over 4,000 students in all units.

W. EMERSON RECK.

**WITTGENSTEIN**, wīt'gən-shtin, Ludwig, Austrian-British philosopher: b. Vienna, Austria, April 26, 1889; d. Cambridge, England, April 29, 1951. Born of wealthy parents and trained as an engineer, he became interested in philosophy while doing aeronautical research in England. After studying with Bertrand Russell in 1912-1913, he began to write the only book he published during his lifetime, the famous *Tractatus Logico-Philosophicus* (parallel English-German ed., 1922). Enlisting in the Austrian Army as a volunteer in World War I, he was captured by the Italians and imprisoned near Monte Cassino. After the war he worked in Austria as a village schoolmaster and as a gardener in a monastery. In 1929 he returned to England to pursue philosophy at Cambridge University, where he lectured informally from 1930. He became a British subject in 1938 and was appointed a professor at Cambridge in 1939. During World War II he worked as a hospital porter and medical assistant. He resigned his professorship in 1947 and died of cancer four years later, leaving a wealth of important writing for posthumous publication.

A man of exceptional literary and artistic gifts, Wittgenstein had a powerful, almost hypnotic personality which profoundly affected the many young English and American philosophers who became his pupils. In private life he was ascetic, of a strongly religious temperament (although he belonged to no sect), deeply attached to his friends, and imbued with a rare seriousness, as much ethical as intellectual. The power of his informal teaching could be compared with that of Socrates, whom he resembled in some ways, although his own philosophical path led in almost exactly the opposite direction. His lifelong stress upon the need for spontaneous discussion of deeply felt metaphysical problems, and the severe standards of expression he demanded, led him to delay publication of his views and discourage any report of them by his disciples. But as word of his later doctrines gradually circulated, he brought about what deserves to be called a revolution in modern philosophy.

**Philosophy.**—The *Tractatus* is one of the most cryptic of all philosophical classics, written in the form of brief epigrams, in a style permeated with striking visual metaphors. Designed originally as a study of the foundations of logic and mathematics, it gradually broadened into an attempt to solve once and for all the central metaphysical problems of the nature of reality. Its chief novelty lies in the attempt to draw metaphysical conclusions from the essential character of the language



in which thought about reality must be expressed. Wittgenstein viewed language as composed of "logical pictures" in which words are substitutes for simple objects and the manner of their combination in sentences reflects the way things hang together in reality. Profound analysis of the necessary character of any representation of reality led Wittgenstein to the striking conclusion that the logical structure which language shares with reality cannot itself be stated but must "show" itself through the limitations of discourse. When an attempt is made in metaphysics to transgress these limits, the result is nonsense, a breakdown of language. Much traditional philosophy is the attempt to say the unsayable, and the *Tractatus* ends with the famous words, which also apply to its own teaching: "Whereof one cannot speak, thereof one must be silent."

This repudiation of traditional philosophy became a central doctrine of the influential philosophical movement known as logical positivism, whose leading figures adapted other parts of the *Tractatus* to their own program. Although Wittgenstein concluded that metaphysics, including his own inquiry, could only result in nonsense, he assigned a positive task to philosophy—the clarification of concepts, which he called the "critique of language." His early masterpiece includes penetrating and stimulating remarks about logic, mathematics, science, and ethics.

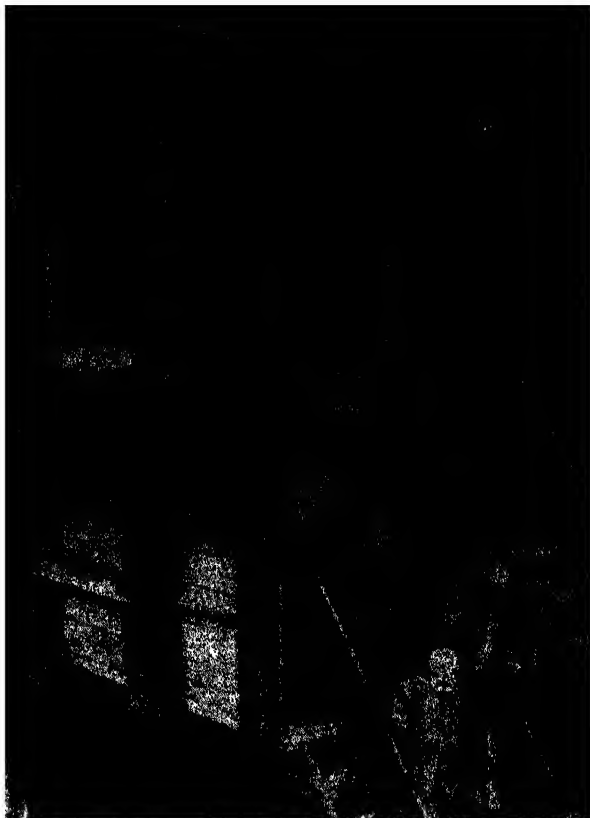
In later life, Wittgenstein rejected as profoundly mistaken the metaphysical picture of a formal correspondence between language and reality which dominated his early book. Philosophers, he said, have constantly gone astray by taking too narrow and one-sided a view of language and the thought it expresses. With inimitable ingenuity and expressiveness, he exhibited the endless variety of linguistic practices. Philosophical perplexity arises when "language idles" by being detached from its proper uses within the concrete settings of the "ways of life" to which it belongs. In a long series of detailed studies in the theory of knowledge, logic, and aesthetics, Wittgenstein went far toward making this claim good. To philosophers reared more conventionally, his emphasis upon close attention to the uses of language often seems irrelevant, and his dismissal of metaphysics as a "mental cramp" appears arbitrary. It is widely acknowledged, however, that Wittgenstein introduced a new style of philosophizing whose effects are likely to be enduring.

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**WITWATERSRAND**, wīt-wô'tərz-ränd (Afrikaans for "ridge of white waters"; commonly known as THE RAND), a series of parallel ranges running from east to west across the Province of Trans-



Information Service of South Africa

These men are leaving the shaft head after working their shift in a Witwatersrand gold mine. There are more than 40 such mines in the Rand.

vaal in the Republic of South Africa, at heights of 5,000 to 6,000 feet above sea level. It is the greatest gold-producing area in the world. The Witwatersrand forms the watershed between the Vaal and Olifants rivers, the former reaching the Atlantic Ocean by way of the Orange River while the Olifants is a tributary of the Limpopo, which flows into the Indian Ocean. The area is about 25 miles wide and extends more than 60 miles from west to east, from Krugersdorp to Springs, with Johannesburg (5,750 feet above sea level) in the center, 480 miles by rail from the Indian Ocean seaport of Durban and 958 miles by rail from Cape Town.

The proven gold area, occupying a strip of country 2 to 7 miles in width, widening in the East Rand to 18 miles, is marked by an almost continuous line of mines with huge white man-made mountains of crushed rock left after the extraction of the gold. The gold occurs in reefs or thin bands of quartz-pebble conglomerates in the Witwatersrand geological system, which consists of a series of beds of quartzites and shales. The reefs resemble a Dutch sweet made of almonds and brown sugar, called banket, and are therefore known as "banket." Of all the reefs, the most productive has been the Main Reef, which in the Central and East Rand consists of three parts (Main Reef, Main Reef Leader, South Reef), each consisting of one or more bands of conglomerate. The Main Reef Leader, varying in thickness from a few inches to as much as 10 feet, is the principal source of ore on the Rand.

Various gold discoveries were reported in the Transvaal after 1850, but the development of the Rand dates from 1884, when Fred Struben,



aided by his brother Harry, discovered that the blanket reef was auriferous. In 1886 the Main Reef was struck, the Witwatersrand goldfields were proclaimed public diggings, and the new settlement of Johannesburg was founded. Not until 1889 was it proved that the reef was not merely a surface deposit. Since then, mining has extended farther and farther below ground, and work now goes on in mines like the Crown and the Robinson Deep at depths of nearly 10,000 feet. Rock temperatures increase 1° F. for every 180 to 200 feet of depth, compared with an average of 1° F. for each 64 feet in most other parts of the world; nevertheless, very costly cooling and ventilation plants and drainage installations are required to make possible mining at such great depths. Water supplies have so far been adequate on the Rand, but they are likely to constitute an important problem in the future. Good-quality coal is readily available from the Witbank-Midlesburg coalfield in eastern Transvaal.

There are between 40 and 50 gold-producing mines, of which the largest include the Blyvooruitzicht and Randfontein in the West Rand, the Crown mine in the Central Rand, and the Dagfontein and East Geduld in the East Rand. In 1960 the Transvaal produced about 14.6 million fine ounces of gold, more than two thirds of the South African total and almost one third of total world production.

In close association with the gold- and coal-mining industries, other industries have developed, including engineering, metal and cement manufacture, clothing, food processing, furniture, and diamond cutting; and the Rand dominates the economy of South Africa from every point of view. The expansion of industry and the concomitant increase of population have also created a huge agricultural market, notably for cereals, market gardening, and dairying. The total population of the Rand had reached almost 2 million by 1960, including nearly 750,000 Europeans. The largest towns, with preliminary census figures for 1960 (metropolitan or municipal areas), are Johannesburg (1,096,541); Germiston (204,605), the chief railway junction in South Africa and the site of the largest gold refinery in the world; Benoni (135,467); and Springs (135,231). Other important urban areas, some of which are contiguous with one another, include Brakpan, Roodepoort-Maraisburg, Krugersdorp, and Boksburg. Potchefstroom, and Klerksdorp, which are newer mining centers to the southwest, are sometimes included.

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**WITWATERSRAND, University of the**, a coeducational, state-supported university located at Milner Park, Johannesburg, South Africa. The largest English-speaking university in Africa, it has an average enrollment of about 6,000. There are eight faculties—arts, science, medicine, engineering, commerce, law, dentistry, and architecture. The institution was incorporated as a university by act of Parliament in 1921 and came into being on March 1, 1922, as the successor to what was originally the South African School of Mines, which had been founded in 1896 at Kimberley and transferred to Johannesburg in 1904. Bachelor's and master degrees are conferred by all of the faculties.

Among the institutions connected with the

university are the Bernard Price Institute of Geophysical Research (founded 1937), the Bernard Price Institute of Palaeontological Research (founded 1946), the Ernest Oppenheimer Institute of Portuguese Studies, and nuclear physics, economic geology, nutritional, cardiopulmonary, and dental research units of the South African Council for Scientific and Industrial Research. The university library contains about 350,000 volumes, including the Gubbins Collection of Africana and the Landau Collection of Hebraica and Judaica. *African Studies*, *English Studies in Africa*, and the *South African Journal of Medical Sciences* are among the publications of the university. Colors are blue and yellow, and the best-known college song is *Umpa*.

KENNETH ANDREW.

**WITZ**, vits, Konrad, Swiss painter and possibly wood carver: b. possibly in Constance (Baden) or Rottweil (Württemberg), Germany, c. 1400; d. Basel, Switzerland, before the end of 1446. Already fortified with Swabian matter-of-factness, he went to Basel about 1430, received the freedom of the city in 1435, and worked there until his death. He seems to have executed important commissions, but the larger works have been dispersed, with panels in various museums. The retable illustrating the doctrine *speculum humanae salvationis* (mirror of human salvation) was the most ambitious of these. From a later altarpiece (1444) comes his masterpiece, *Christ Walking on the Water*, in the Museum of Art and History at Geneva. E. H. Gombrich, in *The Story of Art* (4th ed., 1951), calls it "the first 'portrait' of a real view ever attempted." To capture the attention of the Genevois, Witz painted the very Lake Geneva which they saw every day. Contrasting the fishermen clumsily trying to keep the boat steady with the figure of Christ standing firmly on the water, Gombrich concludes: "It must have been a moving experience for the worshippers in Geneva when they saw it for the first time, when they saw the apostles as men like themselves, fishing on their own lake, with Christ walking on its familiar waters and exhorting them 'Be not afraid' (Matthew xiv. 27)." Possibly Witz alone among the painters of his time had the power to mingle the supernatural and the real with terrifying intensity. If he were not at his best in achieving such a combination, he might be dismissed as a mere realist, though as a realist admirably concerned with space relationships.

WALLACE BROCKWAY.

**WIYOT INDIANS**, we'yöt, a small tribe of North American Indians, who with the neighboring Yurok, are the sole representatives in California of the Algonquian linguistic family. They inhabit the coastal region around Humboldt Bay, from Mad River to Eel River; hence their popular name of Humboldt Bay Indians. They are also known as Blue Lake Indians. The name Wishoshk, which was once applied to them, is an error. Fewer than 230 survived by 1960. Of this number, perhaps about one quarter were full bloods.

FREDERICK J. DOCKSTADER.

**WLADYSŁAW**. See LADISLAS.

**WŁOCŁAWEK**, vwó-tswá'vëk, city, Poland, in Bydgoszcz Province, on the west bank of the Vistula River, about 85 miles west-northwest of

Warsaw. A river port, served by the Łódź-Gdańsk railway, the city is the center of an important agricultural region. Local industries produce cellulose, paper, pottery, agricultural machinery, and metalware. Włocławek is the seat of a Roman Catholic bishopric and contains a famous 14th century Gothic cathedral and other medieval buildings. After a century of Russian rule, it was incorporated in the Polish republic in 1918 and restored to Polish rule after the German occupation in World War II. Pop. (1982) 110,000.

ELLSWORTH RAYMOND.

**WOAD**, wôd, a group of about 50 species of annual, biennial, and perennial herbs of the mustard family (Cruciferae), native to the Mediterranean region and eastward to Iran. Best known is dyer's woad (*Isatis tinctoria*), a European and south-west Asiatic biennial, 1 to 3 feet tall. The basal leaves are oblong or inversely egg-shaped, 1½ to 4 inches long, stalked on petioles nearly as long. The stem leaves are narrower, lance-shaped or linear, stalkless, with two narrow earlike lobes at the base. The flowers are small, to ¼ inch long and yellow, clustered at the end of the stem in a broad and loose panicle. The fruits are capsular, flat, firm, oblong, ½ to ¾ inch long and about ⅓ as wide. At first they are erect, later pendulous, tapering to the base, truncate or notched at the apex, becoming dark purple at maturity. They are one-celled and contain a single seed which hangs from the top of the capsule.

Woad was formerly much cultivated in Great Britain for a blue dye extracted from its mashed, fermented leaves. Eventually it was superseded by indigo. It is still cultivated in some parts of Europe and is said to improve the quality and color of indigo when mixed with it.

In the United States woad blooms in early summer and fruits from June to October. In the Levant, where it inhabits the mountains, its flowers appear in March and April. It is sometimes called asp-of-Jerusalem or Marlahan mustard.

HAROLD N. MOLDENKE.

**WOBURN**, wô'bərn, city, Massachusetts, in Middlesex County, 10 miles northwest of Boston. The city is an industrial and residential center, with manufactures of leather and leather-working machinery, tools, gears, lathes, and chemicals, and electronics research and development laboratories. Market gardening is carried on in the vicinity. Woburn was the birthplace of the world-famous scientist Benjamin Thompson (q.v., 1753-1814), better known as Count Rumford; the house is open to the public. Also born here were the engineer and horticulturist Loammi Baldwin (q.v., 1745-1807), for whom the Baldwin apple is named, and his son Loammi (1780-1838), who has been called the father of civil engineering in the United States. The Baldwin homestead still stands in North Woburn but is not open to the public. The process of vulcanizing rubber was discovered by Charles Goodyear in Woburn in 1839.

First settled as part of Charlestown in 1640, Woburn was incorporated as a separate township in 1642 and as a city in 1889. It was named after Woburn in Bedfordshire, England. Government is by mayor and council. Pop. 35,943.

THOMAS H. MCGOWAN.

**WODEHOUSE**, wôd'hous, P(elham) G(renville), English novelist and humorist: b. Guildford, Sur-

rey, England, Oct. 15, 1881; d. Southampton, N. Y., Feb. 14, 1975. He was knighted in January 1975. After graduating from Dulwich College in 1900 he became a newspaperman in London. His first stories showed skill in creating absurd situations. Psmith, his first comic character, was created in 1910, but his most characteristic work began in 1924 with the publication of *The Inimitable Jeeves*, featuring that perfect valet and his employer, Bertie Wooster of the Drones Club. Mr. Mulliner, relater of tall tales about the aristocracy, appeared three years later. The absent-minded Lord Emsworth of Blandings Castle (1935) completed the cast of major characters who thenceforth marched and countermarched through a succession of delightful novels and stories published by Wodehouse.

Wodehouse was one of the few British writers who could use American English and characters convincingly. In addition to his humorous novels and stories, he collaborated with Guy Bolton in writing the books for several popular Broadway musicals, notably *Sally* (1920), *Sitting Pretty* (1924), *Anything Goes* (1934), and *Bring on the Girls* (1953).

Many of Wodehouse's memorable stories were collected and reprinted in *The Weekend Wodehouse* (1951) and in *The Most of P.G. Wodehouse* (1960). He wrote whimsically of his life and career in *Performing Flea* (1951) and *Over Seventy* (1957).

**WODEN or WODAN.** See ODIN.

**WOESTIJNE**, wôos-tî'nə, Karel van de, Belgian-Flemish poet, novelist, and essayist: b. Ghent, Belgium, March 10, 1878; d. Zwijnaarde, Aug. 24, 1929. A distinguished contributor to the literary periodical *Van nu en straks*, he opposed the popular Flemish regional literature and advocated an aristocratic individualism. In prose narratives such as *Het Vaderhuis* (1903), *Christophorus* (1926) and in verse, both rich in nature symbolism, he sought God and upheld the ideals of the spirit as opposed to the senses. His essays deal with Flemish, Dutch, and French poetry, painting, and sculpture. As a devotee of French culture, professor of the Flemish language in Ghent (from 1919), and member of the Royal Flemish Academy, he had a marked influence upon his generation.

EDWIN H. ZEYDEL.

**WOFFINGTON**, wôf'ing-tən, Margaret (known as PEG WOFFINGTON), Irish actress: b. Dublin, Ireland, Oct. 18, ?1714; d. London, England, March 28, 1760. She first appeared on the stage in Dublin in a children's production of *The Beggar's Opera*, a role which attracted attention and launched her career as an actress. Her playing, in 1740, of Sir Harry Wildair in *The Constant Couple* brought an offer from Covent Garden in London, where she played opposite David Garrick in many famous roles, often impersonating men or fashionable women, and was openly acknowledged as his mistress. On May 3, 1757, she collapsed during a performance and, amid great applause, left the stage, never to return.

Peg Woffington was at her best when cast as an elegant lady of rank, but the audiences preferred her male impersonations. She seldom missed a performance, even if ill, and she gladly accepted secondary parts. Contemporary records reveal her as a kind person who was liked by

almost everyone except rival actresses, one of whom she stabbed during a performance.

DONALD B. CLARK.

**WOFFORD COLLEGE**, wŏf'ord, a liberal arts college for men, located in Spartanburg, S.C. It was founded in 1851 with a legacy left by Benjamin Wofford, a Methodist minister; first instruction was given in 1854. The college, which is largely supported by the Methodist Church, confers bachelor of arts and bachelor of science degrees. The library of 72,000 volumes has a special collection on the history of Methodism in the United States and South Carolina. School teams are known as the "Terriers," and the colors are old gold and black. Average annual enrollment is 800.

KELLER COGSWELL.

**WÖHLER**, vŭ'lar, Friedrich, German chemist: b. Eschersheim, Germany, July 31, 1800; d. Göttingen, Sept. 23, 1882. He began to study medicine in 1820 at Marburg and transferred in 1821 to Heidelberg, where under the influence of Leopold Gmelin he turned his attention to chemistry. After receiving his doctor's degree in medicine, surgery, and obstetrics in 1823, he studied for a year in Stockholm with Jöns Jakob Berzelius, with whom he maintained a long correspondence that was published posthumously. Wöhler taught at technical schools in Berlin and Kassel and in 1836 became professor of chemistry on the medical faculty of the University of Göttingen, where he remained until his death, winning worldwide esteem as an educator. A monument erected in his honor at Göttingen memorializes the service to chemistry of a man who never received formal education in the science.

Wöhler has been credited with beginning the science of organic chemistry. His synthesis of urea from ammonium cyanate in 1828 refuted the prevailing theory that a "vital force" is necessary for the formation of organic compounds. He was among the first to study isomerism. With Justus von Liebig, he investigated oil of bitter almonds and discovered that the benzoyl radical remained the same in each of a series of compounds of the same composition. His other work in organic chemistry included the discovery of amygdalin in 1837 and of hydroquinone in 1848. His work in inorganic chemistry included studies of most known elements. Wöhler was the first to isolate beryllium, which he named, in 1828, and he isolated pure metallic aluminum for the first time in 1845, after having isolated an impure aluminum powder in 1827. In 1862 he prepared calcium carbide. He devised a process for the large-scale manufacture of nickel, and his work on silicon was vital to the development of silicon chemistry. Wöhler was the author of *Grundriss der anorganischen Chemie* (1831), *Grundriss der organischen Chemie* (1840), and more than 300 scientific papers.

**WOHLGEMUTH, Michael.** See WOLGEMUT, MICHEL.

**WOLCOTT**, wŏl'kat, an American family prominent in Connecticut and national affairs during the colonial and early national periods.

**ROGER WOLCOTT:** b. Windsor, Conn., Jan. 4, 1679; d. East Windsor, May 17, 1767. Typical of his generation, he was educated at home and was apprenticed to a trade. He became a successful clothier and farmer, was admitted to the bar, and

was the father of 15 children. In 1710 he was made a justice of the peace and then advanced through the court system to become chief justice of Hartford County in 1741. He was also a member of the colony's legislature during most of these years. Finally, he was chosen deputy governor (1741-1750) and governor (1750-1754). Wolcott's military career was similarly successful, from his first service in 1711 as commissary in Queen Anne's War to his leadership as major general under William Pepperrell in the brilliant siege and capture of Louisburg on Cape Breton Island, Canada, in 1745. His later years were spent in defending the Congregational system of church government. Wolcott's *Poetical Meditations, Being the Improvement of Some Vacant Hours* (1725) was the first book of verse published in Connecticut.

**OLIVER WOLCOTT**, signer of the Declaration of Independence: b. Windsor, Conn., Nov. 20, 1726; d. Litchfield, Dec. 1, 1797. Son of the preceding, he graduated at the head of the class of 1747 at Yale and was given command of a New York company in the projected attack on French Canada. After the peace treaty of 1748, he returned to Connecticut and in 1751 helped to organize the frontier county of Litchfield, which he served as sheriff for the next 20 years. He also represented Litchfield in the colony's legislature and was a probate judge, county court judge, and officer in the colonial militia. In 1775 he helped to negotiate the neutrality of the pro-British Six Nations Indians and later that year was elected to the Continental Congress, where he served throughout the Revolutionary War, except for a short period in 1779. Because of illness he was unable to sign the Declaration of Independence until November 1776. In the summer of 1776, under Gen. Israel Putnam, Wolcott commanded 14 regiments of militia in the Hudson River valley, and the following year his troops fought together with Gen. Horatio Gates against the army of Gen. John Burgoyne in the Battle of Saratoga. In 1779 he was in charge of the defense of the Connecticut coast against British raids. He also helped to conclude the Treaty of Fort Stanwix (1784) with the Six Nations Indians. He was lieutenant governor (1787-1796) and governor of Connecticut (1796-1797).

**OLIVER WOLCOTT:** b. Litchfield, Conn., Jan. 17, 1760; d. New York, N.Y., June 1, 1833. Son of the preceding, he graduated from Yale in 1778, served briefly in the Revolutionary Army, and was admitted to the bar in 1781. He first attracted attention as a specialist in public finance for his work in the settlement of the financial dispute between Connecticut and the federal government in 1784. After serving briefly (1788-1789) as comptroller of accounts for Connecticut, he was named auditor (1789-1791) and then comptroller (1791-1795) of the United States and was a vigorous proponent of Alexander Hamilton's financial program. When Hamilton resigned from the cabinet, Wolcott became secretary of the treasury (Feb. 2, 1795), defending his increasingly unpopular financial program against the attacks of the Jeffersonians. He was kept in office by John Adams, but during the election campaign of 1800, he joined Hamilton in an intrigue against Adams' reelection, and was forced to resign from the cabinet. Wolcott was one of the "Midnight Judges" that Adams appointed to the United States Circuit Court in 1801, but the Democratic-Republican Congress eliminated his

position in 1802. He then turned to commerce and built up a prosperous mercantile business in New York City.

Reentering political life during the War of 1812 as a "War Federalist," he helped to organize (1816) the Toleration Party, a coalition of liberal Federalists and Democratic-Republicans in Connecticut, and was elected governor of the state for several terms (1817-1827). In 1818 he presided over the constitutional convention which adopted a sweeping reform constitution to replace the charter of 1662.

DAVID ALAN WILLIAMS,  
Assistant Professor of History, University of  
Virginia.

**WOLCOTT**, town, Connecticut, in New Haven County, five miles northeast of Waterbury. It has a hilly terrain with many steep slopes. The Mad River and its tributaries comprise the town's major surface drainage system. Although its industrial history began as early as 1760 with a gristmill, no major industrial development ever occurred. Other than agriculture, Wolcott's principal industries are the manufacture of tools and novelties.

Settled permanently in 1731, the area was originally called Farmingbury, a part of the towns of Southington and Waterbury. It was incorporated separately in 1796 and named after Connecticut's governor, Oliver Wolcott. Wolcott was the birthplace of Amos Bronson Alcott (q.v.), father of the famous author Louisa May Alcott, and Seth Thomas (1785-1859), who was a noted clock manufacturer. The town government is of the form that is known as the selectmen-town meeting. Population: 13,700.

ROBERT C. SALE.

**WOLD**, wôld, a term used in England to denote an elevated range of open country, based on chalk or limestone. The Yorkshire Wolds and the Lincolnshire Wolds are parts of a single range divided long ago by the river Humber as it made its way to the North Sea. They are remnants of the great system of chalk ranges spreading out from southern England and including the North and South Downs of Kent and Sussex, the Chiltern Hills of Buckinghamshire, and the Cotswolds—all very much alike in character. The Lincolnshire Wolds run generally northwest for some 45 miles from near the coast of the Wash to the Humber, with an average width of 10 miles and 300 to 400 feet in height. Beyond the Humber they are continued by the Yorkshire Wolds, which at first run northwest and then bear east to end in the high cliffs of Flamborough Head. Their greatest width is about 20 miles and their maximum height 800 feet.

H. GORDON STOKES.

**WOLF, Christian von.** See WOLFF, BARON CHRISTIAN VON.

**WOLF, völf, Friedrich August**, German classical philologist: b. near Nordhausen, Germany, Feb. 15, 1759; d. Marseille, France, Aug. 8, 1824. He studied at the University of Göttingen and in 1782 became rector of the *Stadtschule* in Osterode am Harz. A year later he was professor of philosophy and pedagogy at the University of Halle, remaining there until the institution was suppressed in 1807 during the Napoleonic invasion. He was extremely active as a teacher, lecturer,

and critic and was editor and translator of numerous Greek and Latin classics. Wolf's most famous work, *Prolegomena ad Homerum* (1795), was a landmark in Homeric scholarship and long remained the basis for theories about the authorship of the Homeric poems, as well as other epics such as the *Nibelungenlied*. Wolf contended that the *Iliad* and *Odyssey* were not composed by one poet but by several rhapsodists; some aspects of his thesis (particularly the effect that reduction to writing has on oral tradition) are still valid. In Berlin he finished his most comprehensive study of antiquity, *Darstellung der Altertumswissenschaft* (1807), and was one of the founders of the university there. He was an advocate of classical studies as a mental and cultural discipline and pioneered the science of philology, not in a narrow linguistic sense, but as a means of broadening man's knowledge of human nature as exemplified in antiquity.

EDWIN H. ZEYDEL.

**WOLF, Hugo**, Austrian composer: b. Windischgraz, Austria (now Slovenjgradec, Yugoslavia), March 13, 1860; d. Vienna, Feb. 22, 1903. His fame rests almost entirely upon his approximately 300 solo songs with piano accompaniment, which entitle him to a high position in the line of Schubert, Schumann, Brahms, and Richard Strauss. An unhappy, irascible, psychotic, and finally deranged man, he found daily life extremely difficult, and became involved in highly publicized, unhappy encounters with Wagner, Brahms, and his former fellow student Gustav Mahler; he also fell foul of the most influential music critic of his era, Eduard Hanslick.

After a stormy childhood education, Wolf became a student at the Vienna Conservatory in 1875 but was expelled for insubordination in 1877. He earned a meager living from music lessons and began to compose songs to texts by such poets as Goethe, Nikolaus Lenau, and Heine. After an unsuccessful interlude in Salzburg as a chorus master, he became music critic of the *Wiener Salonblatt* in 1883, using its columns for personal vendettas, which won him many enemies, though he also attracted enthusiasts by his songs. He resigned from the paper in 1887 and thereafter devoted himself wholly to composition. His symphonic poem *Penthesilea*, after the tragedy by Heinrich von Kleist, was composed in 1883-1885; his *Italianische Serenade* was originally written for string quartet in 1887.

Wolf's fame spread after 1889, with publication of his songs to poems by Eduard Mörike, Joseph von Eichendorff, Goethe, Paul Heyse, Emanuel Geibel, and Gottfried Keller. He completed the 22 songs of the *Italianisches Liederbuch*, part 1, in 1891 and 24 songs of part 2 in five weeks in the spring of 1896.

Wolf labored long and painfully over *Der Corregidor*, an opera after Pedro Antonio de Alarcón's *El sombrero de tres picos*; it was heard for the first time at Mannheim on June 7, 1896, and has had numerous stagings since then, but without entering the active repertoire. *Der Corregidor* is couched largely in a curiously inept, unoperatic lieder style and is orchestrally indecisive. Wolf began, but never completed, a second Alarcón opera, *Manuel Venegas*. Societies for the performance of his songs were instituted at Berlin (1896) and Vienna (1897).

For some time, Wolf had showed alarming signs of mental instability brought on by venereal

disease. A disagreement with Mahler, the new director of the Vienna Opera, led to his mental breakdown, and he was placed in a sanatorium on Sept. 20, 1897. He recovered sufficiently to leave on Jan. 24, 1898, but then suffered a relapse, tried to commit suicide by drowning, and requested that he be put into a state asylum, where he declined gradually into complete insanity.

Wolf has probably never been excelled in creating songs that become great dramas in miniature by their telling and subtle combination (often wholly or partly contrapuntal) of piano accompaniment and a plastic, mercurial vocal line that is highly responsive to the suggestions contained in the text.

HERBERT WEINSTOCK,  
Author of "Music as an Art."

**WOLF, Max** (in full MAXIMILIAN FRANZ JOSEPH CORNELIUS WOLF), German astronomer: b. Heidelberg, Germany, June 21, 1863; d. there, Oct. 3, 1932. Attracted to astronomy at an early age, he erected a small observatory where, in 1884, he discovered a comet which bears his name. He then gave up his theoretical interests to devote himself to observational astronomy and astronomical photography. In 1896 he became director of the astrophysical observatory at Königstuhl and in 1901 was appointed to the chair of astronomy and geophysics at the University of Heidelberg, where he remained for the rest of his life.

On Dec. 22, 1891, Wolf discovered the first photographic asteroid (No. 323), for which he was awarded the Lalande Prize of the Paris Academy of Sciences. Eventually he found over 100 such asteroids. Perhaps his greatest contribution to astronomy was his study of the Milky Way and its nebulae. In 1902 he published a catalogue of 1,528 nebulae and about the same time was the first to use the stereocomparator for the discovery of stars with large proper motion by scanning celestial photographs.

I. M. LEVITT.

**WOLF, Rudolf**, Swiss astronomer: b. Fällanden, near Zurich, Switzerland, July 7, 1816; d. Zurich, Dec. 6, 1893. Director of the Bern Observatory (1847) and later the Zurich Observatory (1855), he is best known for his unrivaled historical knowledge of sunspots. In 1852 he discovered independently the coincidence of the sunspot period with terrestrial magnetic field disturbances. At

this time he also corrected Samuel Heinrich Schwabe's determination of the sunspot period from about 10 years to the more nearly correct period of 11.1 years. From a study of the Zurich Chronicles (1000-1800 A.D.) Wolf derived evidence that the aurorae were also related to the sunspot cycle. He also wrote extensively on the history of science.

See also SUN—Sunspot Cycles.

I. M. LEVITT.

**WOLF**, wōlf, the largest wild member of the dog family (Canidae). The gray wolf (*Canis lupus*), or timber wolf, originally had a huge range in North America from Alaska and the Arctic islands to the Mexican tableland, and in Eurasia south to the Mediterranean and parts of India and China. In various local races, it may live in snow and ice or tundra, in forests and woodlands, or in deserts. A smaller red wolf (*C. niger*) is native from Texas to Florida.

Adult gray wolves are 48 to 59 inches long in head and body and stand 33 to 38 inches at the shoulder, with a tail 16 or 17 inches long. Many weigh 50 to 100 pounds, and there is a 175-pound Alaska record. The coat is thick and durable and shows great individual variation in color, from nearly white through gray, rufous, and dusky to pure black; members of one litter may be of several colors. The neck hair is long and erectile.

Wolves trot or gallop, with ears erect, and have both speed and endurance. Commonly they hunt in pairs or packs and are clever in catching small prey or bringing down large hoofed animals. Where undisturbed, they have irregular circuits, 20 to 60 miles in diameter, which they cover every few days. The commonest call is a long, loud, throaty howl.

Adults breed first when 2 to 3 years old; gestation is about 63 days; litters, averaging 7, are born mostly in May. The young are reared in a den, which is either a natural cavity or an enlarged burrow, commonly on a hillside or bluff, often with a narrow entrance and sometimes 30 feet deep. The parents hunt mostly at night, either bolting down flesh from a kill and disgorging it on their return to the den entrance or dragging parts of carcasses to the site. Later the family lives outdoors, often along a hunting route, roughly circular, 20 to 60 miles in diameter, traversed at intervals.

Wolves are strictly carnivorous, feeding pref-



Timber wolf, or gray wolf (*Canis lupus*).

Tom McHugh from National Audubon Society



erably on freshly killed animals, from large birds or rabbits to deer or caribou, although they will eat carrion. Like other canines, they can survive without food for several days and then may gorge up to one fifth of their body weight at a meal. Packs of wolves formerly preyed on herds of bison on the Great Plains of North America; introduction of domestic livestock brought them an added food supply. Horses, cattle, sheep, and pigs are still killed in remote areas.

Since civilization began, wolves have been a menace to man, his herds, and large game animals. In consequence, they have been destroyed by knife, gun, trap, and poison. The wolf was killed off in Great Britain by the 18th century and now is extinct or scarce in most of western Europe. The same is true of the United States and southern Canada, although a few survive in isolated spots. To the north they still are present.

The crafty character of the wolf has given rise to many superstitions and legends and much folklore, as for example the ancient Roman legend of Romulus and Remus (see ROMULUS AND REMUS) or Rudyard Kipling's story of Mowgli. In Europe during former centuries people were apparently attacked and killed by wolves; in early days in America, also, many were followed and some attacked, but there have been few or no authenticated human deaths there. Occasionally, woodsmen have reared wolf pups as somewhat uncertain pets and companions. Wolf pelts were once used for human garb, and wolf flesh is a human food in extremity.

Wild wolves occasionally mate with domestic dogs, and fertile hybrids result. Indeed, the breeds of dogs evidently all were derived from the wolf of Europe by centuries of selective breeding.

See also CARNIVORA; COYOTE; WEREWOLF.

TRACY I. STORER

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**WOLF-FERRARI**, vòlf' fār-rā'rē, **Ermanno**, Italo-German composer: b. Venice, Italy, Jan. 12, 1876; d. there, Jan. 21, 1948. His father, August Wolf (1842-1915), was a well-known German painter; his mother was Italian. After studying art in Rome, he turned to music, becoming a pupil of Josef Rheinberger at Munich (1893-1895). His earliest large works to be produced, both to Italian texts, were an oratorio, *La Sulamite* (Venice, 1899) and an opera, *Cenerentola* (Venice, 1900). He was director of the Liceo Benedetto Marcello, Venice, from 1902 to 1907, then removed to Austria and Germany, teaching at the Mozarteum in Salzburg and residing near Munich. For many years thereafter, his operas, though in the tradition of *opera buffa* and conceived to Italian texts, were given premieres in German in Germany.

Wolf-Ferrari's first major successes, both to librettos derived from comedies by Carlo Goldoni, were *Die neugierigen Frauen* or *Le donne curiose* (Munich, 1903) and *Die vier Grobiane* or *I quattro rusteghi* (Munich, 1906). The most widely popular of his operas was *Susannens Geheimnis*

or *Il segreto di Susanna* (Munich, 1909). His next—and only tragic-opera, was *Der Schmuck der Madonna* or *I gioielli della Madonna* (Berlin, 1911). Returning to comedy, but to less acclaim, he composed, among others, *Der Liebhaber als Arzt* or *L'amore medico* (Dresden, 1913), after Molière's *L'amour médecin*, and—staged first in Italian in Italy, to which he turned increasingly after World War I—*Gli amanti sposi*, again after Goldoni (Venice, 1925); *Sly*, after Shakespeare's *The Taming of the Shrew* (Milan, 1927); two more Goldoni-based scores—*La vedova scaltra* (Rome, 1931) and *Il campiello* (Milan, 1936); and *La dama boba*, after Lope de Vega (Milan, 1939). Although his operas have largely fallen out of the repertoire, the best of his comedies always respond well to revival.

HERBERT WEINSTOCK

Author of "Music as an Art"

**WOLFE**, wòlf, **Charles**, Irish clergyman and poet: b. Dublin, Ireland, Dec. 14, 1791; d. Cove of Cork (now Cobh), Feb. 21, 1823. He graduated B.A. from Trinity College, Dublin, in 1814, tutored there for a year, took Anglican orders, and served as curate in Ulster from 1818 to 1821. His poetical *Remains* was published posthumously in 1825, with a brief memoir by John A. Russell. Wolfe's single memorable work is *The Burial of Sir John Moore*, a poem published in the *Newry Telegraph* in 1817, eight years after the event it commemorates. Moore was mortally wounded in action with the French outside La Coruña, Spain, on Jan. 16, 1809, after saving his army by one of the most brilliant and most desperate retreats in British military history. Wolfe's poem is worthy of its subject.

DELANCEY FERGUSON

**WOLFE**, James, English general: b. Westerham, Kent, England, Jan. 2, 1727; d. Quebec, Canada, Sept. 13, 1759. The son of Gen. Edward Wolfe (1685-1759), he was commissioned in the Royal Marines in late 1741. He fought with distinction at Dettingen (1743) in the War of the Austrian Succession and later at Falkirk and Culloden Moor (1746) in the Jacobite rebellion. His efficient staff work in the unsuccessful expedition against Rochefort, France (1757), brought him to the attention of William Pitt, who sent him with Jeffrey Amherst to attack Louisburg, Nova Scotia, in the French and Indian War. The capture of Louisburg (July 26, 1758) made his name a household word. Young as Wolfe was, Pitt selected him to command the attack on Quebec and promoted him major general. Aided by Adm. Charles Saunders, Wolfe approached Quebec at the end of June 1759. On July 31 the British were repulsed by a stout French defense at Montmorency. Although there was disagreement on the conduct of the campaign between Wolfe and his brigadiers—Robert Monckton, George Townshend, and James Murray—they agreed on the attack of September 13 on the Plains of Abraham. The French were taken by surprise and routed, but Wolfe was mortally wounded. Quebec surrendered on September 18. Although he had his share of luck, his exploit at Quebec was brilliant in the extreme. Next to Lord Amherst, Wolfe played the principal command role in the conquest of Canada from the French. See also CANADA—44. *Canada in the Reorganization of North America: 1752-1763*.

CYRIL FALLS

**WOLFE, Thomas (Clayton)**, American novelist: b. Asheville, N.C., Oct. 3, 1900; d. Baltimore, Md., Sept. 15, 1938. His father, a stonecutter, and his mother, a boardinghouse keeper and real-estate speculator, along with other members of the Wolfe family, were the matrix of his famous first novel, *Look Homeward, Angel: a Story of the Buried Life* (1929). At the University of North Carolina (A.B., 1920) and at Harvard (M.A., 1922), he specialized in playwriting; his early and frustrated ambition was to become a successful playwright.



Thomas Wolfe

Culver Service

Wolfe continued his playwriting in New York City during the mid-1920's, and one of his scripts, submitted to the Neighborhood Playhouse, caught the attention of Aline Bernstein, a talented stage and costume designer who became a dominant influence in his life and work. During these years he wrote *Look Homeward, Angel* and dedicated it to her. The massive manuscript of a rebellious, bitter Southern childhood also caught the attention of Maxwell Perkins, an editor at Scribner's, with whom Wolfe formed the second of the two strong relationships of his adult years. This first novel, published on the eve of the stock-market crash and nationwide depression, was praised and attacked with equal force. It created consternation in Asheville. But there was no doubt that the novel—romantic and rebellious, poetic and satiric, presenting a remarkable picture of a Southern family and a truthful, hard view of a Southern town—marked the emergence of a major talent in American fiction.

Yet Wolfe's troubles had not ended; they had, indeed, hardly begun in a career marked always by turbulence and torment. Since 1924 he had been teaching English at New York University, which he describes in his second novel as the "School for Utility Cultures." He gave up teaching in 1930 and with the aid of a Guggenheim Fellowship was able to travel and live abroad. He wrote literally hundreds of thousands of words for his new novel and discarded a "finished" manuscript on the advice of Perkins. Finally, after Wolfe had worked on it for six years and was still in the midst of "revisions," Perkins sent off, despite the author's protests, the manuscript for *Of Time and the River* (1935). These experiences, too, Wolfe describes in *The Story of a Novel* (1936), an illuminating description of the creative processes.

Wolfe's final two novels were published posthumously. *The Web and the Rock* (1939), his third novel, described with remarkable candor and intensity his experiences with Mrs. Bern-

stein. *You Can't Go Home Again* (1940) continued what was in effect the harrowing saga of Wolfe's autobiography. But these volumes were major fiction, too, and contained brilliant and memorable descriptions of New York society, of Brooklyn in the great economic depression, and of "Altamont" or "Libya Hill" (Asheville) and the South. In his own tortured, groping, stubborn, provincial way, Wolfe had emerged as one of the notable social realists and satirists of his period just when his early and untimely death cut off his career. Other works include two volumes of excellent stories, *From Death to Morning* (1935) and *The Hills Beyond* (1941). *Thomas Wolfe's Letters to His Mother* (1943) was edited by John Terry; *The Letters of Thomas Wolfe* (1956) was edited by Elizabeth Nowell. A popular and sentimental play version of *Look Homeward, Angel*, by Ketty Fring, was produced on Broadway in 1957, an ironic epitaph to Wolfe's own theatrical aspirations.

See also *LOOK HOMEWARD, ANGEL; WEB AND THE ROCK, THE; YOU CAN'T GO HOME AGAIN*.  
MAXWELL GEISMAR,  
Author of "Writers in Crisis," "American Moderns," and other books on American Literature.

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**WOLFE ISLAND**, island, Ontario, Canada, in Frontenac County, at the entrance of the St. Lawrence River at the northeastern end of Lake Ontario, between Cape Vincent, N.Y., and Kingston, Ontario. The largest (49 square miles) of the Thousand Islands, it was originally called Grande Isle, but in 1792 was renamed in honor of Gen. James Wolfe (q.v.). It is primarily a resort area. Marysville is the chief community.

**WOLFENBÜTTEL**, vól'fən-büt-əl, city, Germany, in the State of Lower Saxony, on the Oker River, seven miles south of Brunswick. It has some small canning, chemical, and machine-building plants, but otherwise is largely residential. The most famous edifice is the Ducal Library, built in 1690 and administered by the philosopher and mathematician Gottfried von Leibniz until 1716; from 1770 to 1781 its librarian was the dramatist Gotthold Lessing. The library contains about 400,000 volumes, with a valuable collection of 4,000 incunabula and 8,000 manuscripts. In Wolfenbüttel are the Lessing Theater and the house where Lessing wrote *Nathan der Weise*. There are many 17th century houses and buildings of timber-and-masonry construction, including the town hall (1600).

First mentioned in 1118, Wolfenbüttel grew around a castle built in 1283. From 1432 to 1753 the dukes of Brunswick-Wolfenbüttel made their residence here, occupying a palace which still stands and includes the remains of the old castle. The town was given the name of Heinrichstadt in 1570; this and nearby settlements were amalgamated as the city of Wolfenbüttel in 1747. After World War II, the city was included in the Federal Republic of Germany (West Germany). Pop. (1980) 50,256.

**WOLFF**, vólfr, **Caspar Friedrich**, German anatomist and comparative embryologist: b. Berlin, Germany, 1733; d. St. Petersburg (now Leningrad), Russia, Feb. 22, 1794. The son of a tailor of modest means, he studied anatomy and physiology at the University of Berlin and earned his doctorate in medicine at the University of Halle. Following a tour of medical service in Silesia during the Seven Years' War, he lectured in Berlin, effectively combining the methods of logic with the science of medicine. His provocative doctoral thesis, *Theoria generationis* (1759), demonstrated a structural basis for epigenesis in both plants and animals, but aroused such stifling opposition among contemporary preformationists, including the eminent Albrecht von Haller and Charles Bonnet, that Wolff was unable to become established in Germany. His work remained unrecognized for approximately 50 years.

Meanwhile, upon the invitation of Catherine the Great, Wolff accepted an appointment (1767) in the Academy of Sciences at St. Petersburg, where he spent his remaining years, which were highly productive in spite of the optical limits of the microscopes available in his time. He observed the undifferentiated nature of the growing points of root and shoot in higher plants and considered aerial parts of the plant except the stem to be modified leaves. He also described the mesonephric kidney. His monograph on the development of the chick intestine, *De formatione intestinorum* (1768), set a standard for careful observation. In this work he initiated the idea of leaflike embryonic layers, a concept subsequently enlarged into the germ layer theory by the 19th century embryologists Christian Heinrich Pander and Karl Ernst von Baer.

See also EMBRYOLOGY—6. *History of Embryology*; EPIGENESIS.

E. W. LOWRANCE,  
Professor of Anatomy, School of Medicine, University of Missouri.

**WOLFF** or **WOLF**, **Baron Christian von**, German philosopher: b. Breslau (Pol. Wroclaw), Germany, Jan. 24, 1679; d. Halle, April 9, 1754. He studied at Jena and Leipzig, and in 1706 became professor of mathematics and natural science at the University of Halle. His rationalist views incurred the opposition of Pietist theologians, and in 1723 he was dismissed from his post and banished from Prussia. After teaching for several years at Marburg, he was recalled to Halle by Frederick the Great in 1740 and became chancellor of the university in 1743.

A leading figure of the German enlightenment, Wolff sought to apply the principles of preceding rationalist thinkers, particularly Gottfried von Leibniz, to metaphysics, moral philosophy, and psychology, as well as to the natural sciences, jurisprudence, and other largely empirical disciplines. Wolff, however, lacked the speculative depth of his great predecessors, and his rationalism became a dry and often superficial formalism. Although the Wolffian approach dominated German intellectual circles until the emergence of Immanuel Kant's critical philosophy, his chief importance was as a systematizer and as a popularizer of enlightenment. He was to a large extent the originator of a German philosophical vocabulary, and his comprehensive efforts in various fields laid the groundwork for a distinctively German philosophy.

**WOLFFISH**, wólfr'fish, a fish (*Anarchichas lupus*) of the family Anarchichadidae. This solitary fish is found on both sides of the North Atlantic—from Spitsbergen to France, in Iceland and Greenland, and south to Cape Cod and possibly Cape Hatteras. It is the largest of several species of this family in the North Atlantic. A related genus, *Anarchichthys ocellatus* is the wolf eel of the North Pacific.



Wolffish (*Anarchichas lupus*)

The wolffish has very strong, prominent canine teeth in the front of the jaws, and a double row of molars on the sides; palatine, vomerine, and pharyngeal teeth are also present. The snout is rounded. The long dorsal and anal fins reach to the caudal peduncle. There are no pelvics. Scales are rudimentary. The wolffish is bluish gray with dark bands. It reaches 30 pounds and a length of some 5 feet. In winter it deposits ball-like clusters of large eggs. It eats crustaceans and mollusks.

The wolffish is also known as the sea wolf or sea cat. It has a reputation for ferocity, although that may have more to do with its appearance than its actual behavior.

CHRISTOPHER W. COATES.

**WOLFHOUND**, wólfr'hound, a general term for such breeds of dogs as the Irish wolfhound, the borzoi (Russian wolfhound), the Scottish deerhound, and other large dogs that have been used to hunt wolves or big animal game. They have several characteristics in common—large size, great strength, speed, and stamina. Of the Irish wolfhound it has been said that its success was nearly its ruin, for when wolves disappeared from Ireland, the Irish wolfhound almost did so, too. See also *Dog—Sporting Dog (Hound) Group*.

WILLIAM F. BROWN.

**WOLFRAM**. See TUNGSTEN.

**WOLFRAM VON ESCHENBACH**, vólfräm fôn ésh'an-bäkh, German poet: b. Eschenbach (now Wolframs-Eschenbach), near Ansbach, Franconia, Germany, c. 1170; d. probably there, c. 1220. His position as a *ministerialis* (landless knight) compelled him to seek the support of patrons, of whom the best known was Landgrave Hermann I of Thuringia. Wolfram spent considerable periods between 1200 and 1220 at Hermann's court at Eisenach, where he seems to have met other literary figures of the period. He is principally known for his long narrative poem *Parzival* (q.v.). His other two narrative works, *Titurel* (or *Sigune und Schionatulander*) and *Willehalm*,

are incomplete. He also wrote seven or eight formal love songs (*Minnelieder*), among them some highly imaginative *Tagelieder* (dawn songs), in which he treats the conventional theme of the parting of lovers at dawn with irony and verbal brilliance. All Wolfram's narrative works are distinguished by a deep interest in morality, a wide tolerance, an individual style, and a fine sense of humor. The unique quality of his imagination nearly outdistances the medium of medieval lyric poetry.

*Parzival* is the best of his works and ranks with the greatest imaginative poems in world literature. In spite of Wolfram's own denial, it can be shown that his *Parzival* is based on the incomplete *Perceval* of Chrétien de Troyes, but a great deal has been added either from sources no longer extant or from the poet's own imagination. Wolfram adds a long prologue about Gahmuret, Parzival's father, and names other persons not known to Chrétien. The marriage of Gahmuret to Belakane, a pagan Negro, by whom he has a son Feirefis, enables Wolfram to exploit one of his favorite themes, the essential nobility of many pagans, and by implication to plead for tolerance for them. Parzival's search for the Grail, which in Wolfram's version is a precious stone possessing the properties of a horn of plenty and the fountain of youth, represents man's search for an ideal to live by, and for true religion. It is not an allegory or novel of the education of a Christian man, but rather an account of a great man attaining great ends when he learns that humility and trust in God are essential to his success. The social significance of a group of men devoted to an ideal and pursuing their goal under a specially chosen leader is also stressed.

In spite of many efforts, it is hard to formulate Wolfram's religious ideas with any exactness. It has even been said that he was a Catharist (Albigensian) heretic, but there is no real proof of this. His other major work, *Willehalm*, would seem to demonstrate the opposite. *Willehalm* was written later than *Parzival*, between 1212 and 1220. Wolfram says that he used as a source a copy of the poem *La bataille d'Aleschans* provided by Hermann of Thuringia, but careful study has made it clear that he actually combined elements from several of the poems from the *chanson de geste* cycle of Guillaume d'Orange, although the main story is derived from the *Aleschans* and *Li covenans Vivien*. Whatever his exact sources may have been, Wolfram changed the character of the poem by concentrating interest on the ideas of martyrdom and sainthood and the fundamental conflict between Christian and pagan. The pagans are represented as noble and moral persons, but the ends for which they fight, principally earthly love, are not so lofty as those of the Christians. *Willehalm* is not so commanding a figure as Parzival, but Gyburg, his wife, is one of the noblest female figures in literature. *Willehalm* had won her when she was already the bride of a pagan, Tybalt, and the conflict between the Christians and pagans originally began with efforts to win her back. After her marriage and her conversion to Christianity she remains utterly faithful to *Willehalm*.

Wolfram's other fragment, *Titarel*, deals with the earlier history of Parzival and Sigune, two of the characters in *Parzival*, and is of less importance than his other works. *Titarel* was Wolfram's last work. He is assumed to have died before completing it.

W. T. H. JACKSON,  
Professor of German, Columbia University.

**WOLFRAMITE**, wōl'frā-mīt, a mineral composed of ferrous and manganous tungstates ( $(\text{Fe}, \text{Mn})\text{WO}_4$ ), important as an ore of tungsten. Wolframite is also the name given to a group of minerals which constitute an isomorphous series. Minerals of the wolframite group are composed of ferrous tungstate and manganous tungstate in varying proportions; ferberite,  $\text{FeWO}_4$ , represents one end of the series and huebnerite,  $\text{MnWO}_4$ , the other. Wolframite often refer to the minerals in the series which have an intermediate composition—more than 20 percent of one tungstate and less than 80 percent of the other.

Minerals in the wolframite group are dark in color, ranging from brown (huebnerite) to black (ferberite); hence they have been called "black ore." They occur as monoclinic crystals, distinguished by perfect cleavage in one direction and by a high specific gravity, about 7.0 to 7.5. They are brittle and have a hardness rating of 5.0-5.5 on the Mohs scale. Wolframite minerals usually occur in quartz veins, associated with granite rocks and are often found with cassiterite and scheelite. Most of the wolframite production in the United States comes from the states of Colorado, Idaho, and North Carolina.

SANDRA LESSER.

**WOLFSBANE.** See ACONITE.

**WOLFSBURG**, wōlfs'bōōrkH, city, Germany, in the State of Lower Saxony, on the Aller River, 16 miles northeast of Brunswick. It was founded in 1938 as the site of the Volkswagen automobile plant and experienced a rapid growth with the expansion of this industry and the influx of refugees from East Germany after 1945.

An outstanding architectural feature is the modern-styled Cultural Center, finished in marble and copper, designed by the noted Finnish architect Alvar Aalto, and opened in 1962. The city was included in the Federal Republic of Germany (West Germany) after World War II. Pop. (1983) 124,609.

**WOLFVILLE**, wōl'f'vīl, town, Nova Scotia, Canada, on the south shore of Minas Basin, at the mouth of the Cornwallis River, about 65 miles northwest of Halifax. It is three miles from Grand Pré, made famous by Henry Wadsworth Longfellow's *Evangeline*, and a convenient center for visits to Cape Blomidon, Cape Split, the Gasperau Valley, and *Evangeline Beach*, which offers unusually warm saltwater bathing. The surrounding district is devoted to fruit growing, mixed farming, and dairying. Acadia University (q.v.) is situated in Wolfville.

Settled in 1760-1761 by New England planters, chiefly from Connecticut, the place was first known as Horton, then Central Horton, and, for a brief period, Mud Creek. It was given its present name about 1840 in honor of the DeWolfe family and incorporated as a town in 1893. Cleveland House is maintained as a museum by the Wolfville Historical Society. Population: 3,235.

WALTER J. KONTAK.

**WOLGAST**, vōl'gäst, town, Germany, on the estuary of the Peene River where it enters the Baltic Sea opposite the island of Usedom, 16 miles east of Greifswald. The town has a few plants making

agricultural tools, some small iron forges, and wood manufacturing. Wolgast received its city charter in 1282 and was the seat of the dukes of Pomerania-Wolgast from 1295 to 1625. During the Thirty Years' War, the Austrians under Albrecht von Wallenstein captured the fortress (1628), and the Swedes occupied it in 1630 and 1638. It was awarded to Prussia in 1815. After World War II, it was included in the German Democratic Republic (East Germany), from 1952 in the district of Rostock. Pop. (1957) 13,964.

**WOLGEMUT** or **WOHLGEMUTH**, wōl'gə-mōōt, **Michel**, German painter and wood engraver: b. Nürnberg, Germany, 1434; d. there, Nov. 30, 1519. Having one of the busiest studios in southern Germany, he attracted many young artists, including Albrecht Dürer, who studied with him from 1486 to 1490. This fact has added luster to his name, but how important a painter he was in his own right is not at present entirely clear. Pictures formerly attributed to him are now given to his teacher Hans Pleydenwurf (whose widow Wolgemut married), to his stepson Wilhelm Pleydenwurf, and even to Dürer himself. The Zwickau altarpiece has remained solidly in the Wolgemut column, but the wonderful Hof altarpiece, now at Munich, has been assigned to the elder Pleydenwurf; and while the Zwickau work is vigorous and noteworthy for its careful detail, the Hof masterpiece has a grandeur and quiet lyricism that cannot be found in the other composition. What remains certain is that Wolgemut ran his large studio with a flair for business and art combined, carrying out all sorts of commissions. His 650 engravings for the Nürnberg chronicle influenced Dürer.

WALLACE BROCKWAY.

**WOLIN**, wōl'ēn (Ger. WOLLIN), town, Poland, in Szczecin Province, on the Dievenow arm of the Oder River, 30 miles north of the city of Szczecin (Stettin). It is a small fishing port in the southern part of Wolin Island (95 square miles), which lies between the Dievenow and the Baltic Sea. The old Wendish trading post of Vineta (Julin, Jumneta, and Jomsburg) is supposed to have been located here and destroyed by the Danes in 1098. For a short time in the mid-12th century Wolin was the seat of a bishopric and it was incorporated as a town in 1250. During the Thirty Years' War, it was taken over (1630) by Sweden, and in 1720 it became a part of Prussia. It came under Polish administration in 1945. Pop. (1962) 3,000.

**WOLLASTON**, wōl'əs-tən, **William Hyde**, English scientist: b. East Dereham, Norfolk, England, Aug. 6, 1766; d. London, Dec. 22, 1828. Born of a moderately well-to-do family, he was educated at Charterhouse and Caius College, Cambridge, where he took the degree of doctor of medicine in 1793. Although possessed of the attributes of an excellent doctor—intelligence, extraordinarily keen senses, and superb manipulative ability—he was unhappy as a practicing physician and in 1800 turned to chemistry and physics.

Between 1803 and 1805 Wollaston focused his attention on the problem of procuring platinum in a malleable form so that it could be easily shaped. His efforts were successful and his fortune assured. The relative inertness of platinum made it an ideal material for use in the production of sulfuric acid, and Wollaston's process

permitted the large-scale use of this metal in industry. From 1802 until his death a whole host of discoveries flowed from his laboratory. His work on platinum led him to the discovery of two new metals—palladium (1803) and rhodium (1804). In 1802 he first used the method of total reflection for the measurement of refractivity. In the same year he invented a primitive form of spectroscope and first observed the dark lines in the solar spectrum now known as Fraunhofer lines. His interests in optics and in mineralogy led him to the invention of the reflecting goniometer in 1809. With this instrument it was possible, for the first time, to make accurate measurements of crystal angles and to place crystallography on a firm quantitative base.

In chemistry, Wollaston was particularly intrigued with the consequences of John Dalton's new atomic theory, and he tried in vain to convert his friend Sir Humphry Davy to it. He contributed papers of considerable worth to the theory of multiple proportions and constructed an accurate table of equivalents for the chemist's use. He also investigated the new phenomenon of the voltaic cell and showed, in 1801, that the electricity generated by this apparatus was identical with common or static electricity. He was elected a fellow of the Royal Society in 1794.

L. PEARCE WILLIAMS,

*Professor of History, Cornell University.*

**WOLLASTON LAKE**, lake, Saskatchewan, Canada, northwest of Reindeer Lake and southeast of Lake Athabasca, with an area of 796 square miles. It drains into the Churchill and Mackenzie river systems. The lake was named in 1821 after William Hyde Wollaston (q.v.).

**WOLLASTON PENINSULA**, a promontory of Victoria Island, Northwest Territories, Canada, in Franklin District. The peninsula, 60 to 70 miles wide and about 140 miles long, is in the southwest part of the island, bounded on the north by Prince Albert Sound, on the west by Amundsen Gulf, and on the south by Dolphin and Union Strait. It was originally named Wollaston Land, after William Hyde Wollaston (q.v.), by Sir John Franklin in 1821. Read Island is off the south coast.

**WOLLASTONITE**, wōl'əs-tən-īt, a mineral  $\text{CaSiO}_3$ , formerly classified as a member of the pyroxene group, but its atomic arrangement has been found to consist of  $\text{SiO}_4$  chains differently oriented from those of pyroxenes. Wollastonite is triclinic and usually occurs in cleavable or fibrous masses, with (100) and (001) cleavages. The hardness is 4.5 to 5.5, and the specific gravity 2.9. It is usually white and translucent, and has a vitreous to silky luster. It is a contact metamorphic mineral and occurs with diopside, tremolite, and lime garnet in highly metamorphosed siliceous limestones. It has been found in California, Norway, Rumania, Mexico, and Hungary, and is mined at Willsboro, N.Y. It is used as a paint filler and in ceramic products such as electrical insulators, tiles, and porcelain. Parawollastonite is a monoclinic form, with very similar properties, formed at higher temperatures. Wollastonite was named after the English scientist William Hyde Wollaston (q.v.).

LEWIS S. RAMSDELL.

**WOLLEGA**, wōl'ə-gə (sometimes **WALLEGA** or **WALLAFA**), province, Ethiopia, in the west cen-



tral part of the country, bordered by the Sudan on the west and by the provinces of Gojjam on the north, Shoa on the east, and Kaffa and Ilubabor on the south, with an area of about 25,900 square miles. A mountainous region averaging 4,500 to 9,000 feet, it contains the peaks of Tula Wallel (10,830 feet) and Nasi (9,708 feet). Principal rivers are the Birbir, Dabus, and Dadessa, and the northern boundary is formed by the Blue Nile. Wollega produces coffee, beeswax, and hides for export and is one of the most important mining districts of Ethiopia, with gold and platinum in considerable quantities. Cobalt and mica have been discovered in the Nejo area but are not exploited. Lekemti (Nakamti) is the capital of the province; other major towns are Asosa and Dembidollo (Saio).

**WOLLIN.** See **WOLIN**.

**WOLLO**, wól'ó (sometimes **WALLO**), province, Ethiopia, in the northeast part of the country, bordered on the northeast by the region of Eritrea, on the east by Djibouti, and by the Ethiopian provinces of Harar and Shoa on the south, Gojjam and Begemdir on the west, and Tigre on the north, with an area of about 30,400 square miles (78,700 sq. km.).

The eastern part of the province is occupied by plains and the Danakil desert, while the west is higher, rising to about 13,745 feet (4,189 meters) in the peak of Abuna Josef. Salt extraction, stock raising, and the cultivation of grain and cotton are the principal occupations. Dessye is the capital and major town of the province. Lalibala, near Abuna Josef, is a noted center of religious pilgrimage for Coptic Christians.

**WOLLONGONG**, wōl'an-gōng, city, Australia, in New South Wales, on the Pacific Ocean, about 50 miles south of Sydney. Greater Wollongong, with an area of 276 square miles, was formed in 1947 by the amalgamation of the former municipalities of Wollongong (1859), Central Wollongong (1859, including Port Kembla), and North Illawarra (1868), and the shire of Bulli (1906). Its widely spread urban centers, on a narrow strip between the ocean and the Illawarra Range, are tending to merge as the city grows. Steel milling and fabricating, centered at Port Kembla, are the major industries, with coal mining in the Illawarra Range, coke making and brickmaking. Textiles and clothing are also manufactured. Port Kembla has an artificial harbor. Rural industries have declined in the area but still are sufficient for most local needs; dairying is especially important in the south, around Lake Illawarra.

Settlement of the area began in 1815, and the town of Wollongong was established in 1834. There are spectacular views from Sublime Point and Mounts Keira and Kembla in the Illawarra Range. The city has a technical college. Pop.

5) Greater Wollongong, 211,068.

R. M. YOUNGER.

**WOLLSTONECRAFT, Mary.** See **GODWIN, MARY WOLLSTONECRAFT**.

**WOLSELEY**, wōl'zē, **Garnet Joseph**, 1st **VISCOUNT WOLSELEY**, British field marshal: b. County Dublin, Ireland, June 4, 1833; d. Menton, France, March 25, 1913. Commissioned as a 2d lieutenant in 1852, he distinguished himself first in the Second Burmese War (1852-1853) and

then in the Crimea, where he lost an eye in 1855. He also fought with distinction in the Indian Mutiny (1857-1858) and in the capture of Peking, China (1860). The next decade was spent as a staff officer in Canada; early in the American Civil War he managed to visit Gen. Robert E. Lee, whose military genius fascinated him. In 1870 Wolseley commanded the Red River expedition against Louis Riel's rebellion and acquitted himself brilliantly. Meanwhile he had published *The Soldier's Pocket Book for Field Service* (1869), which achieved great popularity as a military manual.

Brought home to the War Office in 1871, Wolseley became the chief uniformed supporter of Edward Cardwell's attempts to reform the British Army by the introduction of the short service, the creation of a reserve, and the abolition of the purchase of commissions. His efforts at army reform were interrupted by participation in the Ashanti War (1873-1874) in Africa, where his capture of Kumasi brought him fresh fame, and the Zulu War (1879). In 1882 he was made adjutant general of the army and led the campaign against Arabi Pasha, culminating in the smashing victory at Tell el Kebir, Egypt, for which he was raised to the peerage as Baron Wolseley of Cairo and Wolseley. In 1884-1885 he commanded the expedition that just failed to rescue Gen. Charles George Gordon at Khartoum, but his effort was rewarded with elevation to the viscountcy (1885). He spent the remainder of his career in efforts to complete the reform of the army. In 1894 he was promoted field marshal, and was commander in chief from 1895 to 1900. Although he never met a European foe on the field of battle all that he did he did admirably. The popular expression, "It's all Sir Garnet," when things went well, shows how much he was appreciated. He published books on Marlborough (1894) and Napoleon (1895) and the autobiographical *The Story of a Soldier's Life* (2 vols., 1903). He was immortalized as W. S. Gilbert's "very model of a modern major-general" in *Pirates of Penzance*.

CYRIL B. FALLS.

*Emeritus Professor of the History of War, Oxford University.*

**WOLSEY**, wōl'zē, **Thomas**, English statesman and cardinal: b. Ipswich, Suffolk, England, 1474 or 1475; d. Leicester, Nov. 29, 1530. The son of a butcher, he overcompensated for his origins by his inordinate accumulation of wealth, overweening pride, and magnificence, in the course of a spectacular career. A clever boy sent early to Oxford, he graduated B.A. at 15 and became a fellow and bursar of Magdalen College, where, according to tradition, the completion of the famous tower was due to his energy. In 1498 he was ordained a priest. His ability and industry soon marked him out, and through the patronage of Sir Richard Nanfan, lord deputy of Calais, who made him his executor, Wolsey rose to the notice of Henry VII. The king used him on minor diplomatic missions to Scotland and to the Netherlands in 1508 and shortly before his death in 1509, made him dean of Lincoln. Thus began Wolsey's impressive career in diplomacy and administration and his fabulous accumulation of preferments in the church.

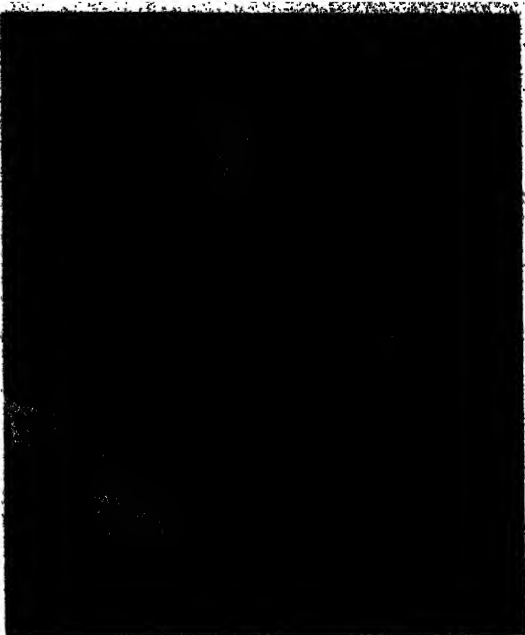
Henry VIII's first French war (1511-1513) went badly until Wolsey grasped the situation with his usual energy and prepared the way for the

victory at Théroutanne and the capture of Tournai (1513), of which he was given the bishopric. His success was further rewarded and his power sealed by his being made bishop of Lincoln and then archbishop of York in 1514. In 1515 he was made a cardinal and in 1518 legate *a latere* for life, an unprecedented position which gave him virtual control over the English church, above the archbishop of Canterbury. In 1515 also, the king made him lord chancellor, so that secular as well as ecclesiastical jurisdiction was concentrated, under the royal power, in Wolsey's hands. Though the event was unexpected by either, this paved the way for the Reformation on Wolsey's fall, and the concentration of both jurisdictions in the monarchy. Wolsey's career, therefore, marked the end of the medieval order and a decisive transition to the new.

Wolsey intended to use his vast powers for reform, and he suppressed a number of small and failing monasteries to found his school at Ipswich; the grandest of the colleges at Oxford, Cardinal College, which became Christ Church; and various lectureships. He was a genuine patron of learning, and his administration was tolerant and nonpersecuting. But his main energies were deflected into a sterile diplomacy, the pursuit of a more decisive position for England in the conflict of European powers than her strength and resources warranted. Western Europe was dominated by the conflict between France and the Holy Roman Empire, between Valois and Habsburg. England's traditional alliance, because of her trading connection with the Netherlands, was with the Empire. Wolsey's conception of the balance of power was to use England as a weight, now on one side, now on the other, against whichever power was too strong, and thus to raise his country's prestige and himself, if possible, to the papacy. This spectacular policy appealed to Henry VIII, and on it he and Wolsey used up the real resources built up by the prudent Henry VII in cash and favorable trade treaties.

The death of Emperor Maximilian I in 1519 led Wolsey and Henry to think of themselves as the arbiters of Europe. At the famous Field of the Cloth of Gold near Calais, in 1520, they met with Francis I of France in extravagant splendor that led to nothing, for shortly thereafter an alliance was concluded with the new emperor, Charles V. When war broke out between France and the Empire in 1521, Wolsey had no desire to take part in it; but he was overborne by anti-French feeling in England and by Henry and Queen Catherine, Charles V's aunt. It soon became evident that the emperor, hard pressed financially, intended to use English resources for his own designs against France, while he had no intention of seeing Wolsey made pope and gave him no support at the elections for the papacy in 1522 and 1523. Meanwhile Wolsey had to bear the burden of unpopularity with Parliament and country for the heavy taxation necessary to raise the immense sums to support the alliance and the war. Public opinion mounted against him; it has left its mark in literature in the satires and invectives of John Skelton and others. His personal extravagance made him an easy target: he was building York Palace, which became Whitehall Palace at Westminster, and Hampton Court up the Thames.

In 1525 Francis I was defeated by the emperor at Pavia and taken prisoner. This took the world by surprise and overthrew the whole structure of Wolsey's European policy—the maintenance of a



NATIONAL PORTRAIT GALLERY

Thomas Cardinal Wolsey, lord chancellor of England, was one of Europe's leaders in the early 16th century.

balance of power, if possible peace, and the independence of the papacy. Instead, there followed the ascendancy of Charles V, the imprisonment of Pope Clement VII, and the sack of Rome (1527). Those powers that felt themselves threatened came together in the League of Cognac, and England passed over to the side of France against the emperor. This was very unpopular in England, but it coincided with Henry VIII's personal desire to rid himself of Queen Catherine, marry Anne Boleyn, and ensure the succession to the throne with a male heir.

Henceforth, Wolsey was caught in a hopeless impasse. With the pope under the emperor's control, he could not procure the annulment of Henry's marriage to Catherine; in 1529 the case, which had been submitted to Lorenzo Cardinal Campeggio and Wolsey as joint papal legates, was revoked to Rome, and Wolsey's failure was made visible. With his fall imminent, Anne Boleyn passed over to the opposition, and his opponents in council and among the nobility joined to drive him from power. In October 1529 an indictment was drawn up against him as incurring the penalties of praemunire for accepting the commission as legate. Wolsey pleaded guilty, and all his temporal possessions were surrendered to the crown. There remained to him his archbishopric of York, which he had never set foot in, and there he repaired to take up his pastoral duties in the spring of 1530. Pursued by the malice of his enemies, in particular Thomas Howard, 3d duke of Norfolk, leader of the nobility, he was summoned back to London to answer charges of high treason. He died on the way, at Leicester Abbey. He was the last of the medieval princes of the church to rule the English state, and his fall left the way wide open for the breach with Rome and all its consequences in the Reformation, the dissolution of the monasteries, and the independence of the English church on a national basis.

A. L. ROWSE, *Oxford University*

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**WOLSTENHOLME TOWNE**, wŏl'stan-hŏm, an archaeological site in southeastern Virginia, on the James River, about 10 miles (16 km) east of Jamestown. It contains the remains of a plantation founded in 1619 by colonists sent by the London Company. The excavation, which began in 1976, revealed the earliest town plan in colonial British America.

Relics at the site include human skeletons, gold and silver objects, clothing fragments, arms, and armor. Excavation has identified the outlines of a fort, dwellings, stables, and storage and warehouse buildings. The settlement, which may have housed as many as 200 inhabitants, was destroyed during an Indian uprising in March 1622. It was named after Sir John Wolstenholme, a London Company shareholder.

**WOLVERHAMPTON**, wŏl'vər-hamp-tən, a city in west central England, in the metropolitan county of the West Midlands, 13 miles (21 km) northwest of Birmingham. It occupies a low ridge in the northwest of the great Midlands industrial region and has excellent road, rail, and canal facilities. Until the Industrial Revolution, its main trade was in agricultural products and wool, but with the iron and steel industry it grew to be the "capital of the Black Country," noted for keys, locks, and buckles, which are still among its specialties. Later it tended to concentrate on heavy industry, and it manufactures a wide variety of products ranging from synthetic fibers to motorcycles and from electrical equipment to automobile tires.

The town derives its name from Wulfruna, sister of King Edgar, who in 996 founded a college here. The Church of St. Peter is mainly 13th to 15th century work and has a remarkable tower and finely carved stone pulpit and font. Medieval Flemish glass is in the chancel windows. The carved shaft of a stone cross in the churchyard is probably from the 12th century. Wolverhampton also has a good art gallery and museum. Population: (1981) 252,447.

H. GORDON STOKES

*Author of "English Place-Names"*

**WOLVERINE**, wŏl-və-rēn', a powerful carnivore of the weasel family (Mustelidae), reputed to sometimes drive bears and cougars from their

prey. The wolverine has a heavy build with an arched back, a bearlike head, massive limbs, large feet, long hair, and a bushy tail. It is mostly dark brown with a yellowish brown strip from shoulder to rump on each side. The forehead is white, and the undersurface, face, and tail tip are black. Its head-body length ranges from 25 to 40 inches (650–1050 mm) with a 7- to 10-inch (170–260 mm) tail. It weighs 15 to 70 pounds (7–32 kg).

The wolverine eats animals ranging in size from lemmings to caribou, although larger animals usually are eaten in the form of carrion. It strips trap lines of bait or captured animals and breaks into vacant cabins. It often spoils more than it eats with its strong skunklike spray. It is active the year round, mostly at night, and solitary except when mating. One to five young are born between January and April and leave their mother in the fall.

Once found over much of northern Europe and North America, the wolverine is now largely restricted in Eurasia to the northern Soviet Union and parts of Scandinavia. In North America it is found mainly in the tundra and coniferous forests of Alaska, British Columbia, and above the 55th parallel in the rest of Canada. Nearly extinct in the 48 states by the 20th century, wolverines have made a comeback and are now reported from northern California to western Montana.

**WOMAN IN WHITE**, *The*, a novel by William Wilkie Collins, published in 1860 after being serialized in Charles Dickens' magazine *All the Year Round*. The novel was brilliantly successful and is usually bracketed with *The Moonstone* (1868) as a supreme example of the author's skill in constructing plots. The story is told in a succession of separate narratives by different characters, each seeing and recording only a portion of the action. The plot concerns a conspiracy against the life, property, and sanity of Laura Fairlie by her husband, Sir Percival Glyde, abetted by Count Fosco. She is saved through the resourcefulness of her half-sister, Marian Halcombe. The villains are throwbacks to those of the Gothic romances, but redeemed from mere melodrama by sinister intelligence. Collins himself, in his preface, explained in a single sentence its popularity: "Here is a novel which has met with very kind reception because it is a Story."

DELANCEY FERGUSON, *Brooklyn College*

**WOMAN KILLED WITH KINDNESS, A**, a play by Thomas Heywood, written and probably acted in 1603, published in 1607. It is Heywood's masterpiece and one of the best early examples of English domestic tragedy. The main plot concerns the infidelity of the wife of a Yorkshire country gentleman. The husband, in a sort of Christian reversal of conventional revenge plays which demanded blood and violence, decides to kill her "with kindness" by sparing her life but banishing her from his home and children. He provides for her existence in an isolated house, where she dies of self-imposed starvation.

The play has been revived successfully in the 20th century. Some of the scenes are dramatically and psychologically effective for a modern audience or reader; they concern real problems of rather ordinary people. But the play is marred by an overwrought, melodramatic subplot.

WILLIAM BRACY, *Reaver College*

An American wolverine.

WILLIAM W. BACON III, FROM RAPHO GUILLUMETTE

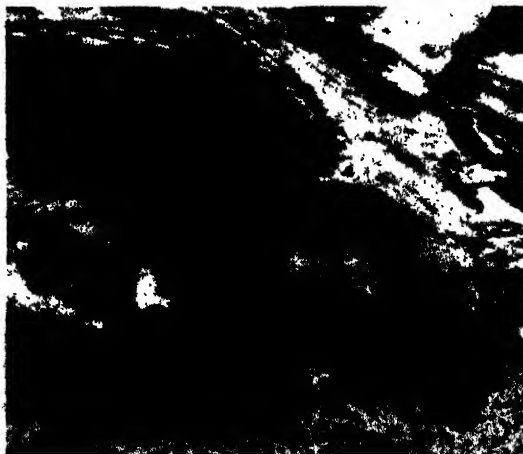




PHOTO WORLD

The efforts of the suffragettes led to passage of the 19th Amendment, giving American women the right to vote.

**WOMAN SUFFRAGE**, suf'rij. Women in most of the countries of the world today can vote and be elected to public office on the same basis as men. In some countries where the franchise has not been fully gained, women can vote in local elections or in national elections with certain limitations. In a few countries they cannot vote at all. The almost worldwide recognition of the political rights of women came, however, only after centuries of work by individuals and later by organizations and intergovernmental bodies. The right to vote became the basic demand of feminist movements because the election was considered to be the fundamental act of political life. The vote was essential because in the political arena the basic decisions are made that shape the patterns of society in which women live. Once gained, it could be used to eliminate other discriminations. Historically, suffrage came first, eligibility to hold office next, and actual access to public office still later.

The philosophy underlying the demand for woman suffrage was the doctrine of natural rights. The woman suffrage movement itself was generally allied with other social reform movements, such as the abolition of slavery, temperance, and the extension of education. Although the movement was led primarily by women, it enlisted from the beginning the support of many men. Opposition took on different shapes in different countries. Political parties were uncertain of the effect of women's votes. There was religious opposition to their participation in anything that did not pertain directly to the home and the rearing of children. Economic interests wanted to keep women as a voiceless labor force. Specific industries, particularly the brewing and distilling industries, feared the woman's vote as an ally of the temperance movement.

In general, established laws, customs, attitudes, and habits of thinking were slow to change, especially when they involved the acceptance of new ideas about women and their place in society.

## UNITED STATES

As early as 1647, Margaret Brent demanded a "place and voyce" in the Maryland Assembly. Although she was the executrix of Gov. Leonard Calvert's will, her request was denied. From 1691 to 1780, women who were property owners voted in Massachusetts. After the Revolution, New Jersey temporarily granted suffrage to women when, in 1790, a revision of the electoral law used the words "he or she"; women voted under this provision until 1807, when the legislature limited the vote to white male citizens.

**Seneca Falls Convention.** By the 1830's and 1840's increasing efforts were being made to awaken women to ask for full enfranchisement. Paulina Wright Davis, Lucretia Mott, Lucy Stone, Ernestine Rose, Abigail Kelley Foster, and Angelina and Sarah Grimké spoke out for women's rights. Books such as Margaret Fuller's *Woman in the Nineteenth Century* (1845) had an influence. Then, in June 1848, Elizabeth Cady Stanton, Lucretia Mott, Martha C. Wright, and Mary Ann McClintock issued a call for a convention to discuss the rights of women. Meeting in the Wesleyan chapel at Seneca Falls, N.Y., on July 19 and 20, the convention adopted a Declaration of Principles patterned on the American Declaration of Independence. Signed by 68 women and 32 men, the Seneca Falls declaration stated: "We hold these truths to be self-evident: that all men and women are created equal. . . . The history of mankind is a history of repeated injuries and usurpations on the part of man toward woman, having in direct object the establishment of an absolute tyranny over her. . . ." The convention demanded for women the right of equal education and the right to preach, to teach, and to earn a livelihood. It also passed a resolution stating "that it is the sacred duty of the women of this country to secure to themselves their sacred right to the elective franchise." Thus was laid the foundation for the woman suffrage movement in the United States.

**Growth of the Movement.** The Seneca Falls convention was followed by conventions in other states. In 1850 the first national convention was held in Worcester, Mass., with delegates from nine states present. Another convention held in Syracuse, N.Y., in 1852 was significant because it marked the first joint venture of Susan B. Anthony and Elizabeth Cady Stanton, who for the next 50 years were in the forefront of the fight for equality for women in the United States. The convention idea continued to spread until women in many states were gathering to launch educational and legislative programs to change the state constitutions and gain legal recognition of woman's right to vote.

Following the Civil War, the woman suffrage movement split over tactics. On May 15, 1869, those who felt that the success of the movement required the enactment of an amendment to the United States Constitution formed the National Woman Suffrage Association, with Susan B. Anthony and Elizabeth Cady Stanton as its leaders. In November 1869 the American Woman Suffrage Association was established to obtain woman suffrage through amendment of state constitutions; its principal leaders were Lucy Stone and Julia Ward Howe. In 1890 the two organizations amalgamated in the National American Woman Suffrage Association, and both methods of work were followed. Mrs. Stanton became its president (1890-1892), followed by Susan B. Anthony (1892-1900), Carrie Chapman Catt (1900-1904), Anna Howard Shaw (1904-1915), and Carrie Chapman Catt (1915-1920).

**Adoption by States.** Although widows were granted suffrage in school matters in Kentucky in 1838, the first victory for general woman suffrage came in 1869 in the Territory of Wyoming. When Wyoming came into the Union in 1890, it became the first state to provide for woman suffrage in its constitution. It was followed by Colorado (1893) and Utah and Idaho (1896). Fourteen years passed until another state, Washington, granted women the right of equal suffrage (1910). This was followed by California (1911); Arizona, Kansas, and Oregon (1912); Alaska Territory (1913); Montana and Nevada (1914); New York (1917); and Michigan, Oklahoma, and South Dakota (1918). Suffrage in presidential

elections was won in Illinois (1913); Nebraska, North Dakota, and Rhode Island (1917); and Indiana, Iowa, Maine, Minnesota, Missouri, Ohio, Tennessee, and Wisconsin (1919). Woman suffrage in primary elections was won in Arkansas in 1917 and in Texas in 1918.

**The 19th Amendment.** Though the National American Woman Suffrage Association was proud of its record in gaining amendments to state constitutions, it was clear that full woman suffrage could be realized only through an amendment to the United States Constitution. Known as the "Anthony Amendment," it was introduced by Sen. Aaron A. Sargent of California in 1878 and read: "The right of citizens of the United States to vote shall not be denied or abridged by the United States or by any state on account of sex." The amendment was defeated in the Senate on Jan. 25, 1887, by a vote of 16 to 34, and although it was reintroduced in each succeeding Congress, it lay dormant until 1914. Then, spurred by a petition of almost 500,000 names presented to Congress by the National American Woman Suffrage Association, and by the agitation of the National Woman's Party led by Alice Paul and Lucy Burns, Congress reconsidered the "Anthony Amendment." On March 19, 1914, the amendment was defeated in the Senate, 34 in favor and 35 against; the House defeated it on Jan. 12, 1915, 174 to 204. Both votes fell considerably short of the necessary two-thirds majority.

The active role of women in World War I helped greatly to change the picture. On Jan. 10, 1918, the amendment was passed by the House, 274 to 136, and the Senate followed suit on June 4, 1919, 66 to 30. Extensive campaigns were waged in the states for ratification. On Aug. 18, 1920, Tennessee became the 36th state to ratify the amendment, and 8 days later it was proclaimed part of the United States Constitution as the 19th Amendment.

#### BRITAIN

The suffrage movement in Britain paralleled the movement in the United States. Here, too, there were early efforts to gain the franchise for women. In the 15th century, women petitioned for the right to vote. Books like Mary Wollstone-



The protest parades of England's suffragettes—and their able service during World War II—helped win British women the franchise.



craft Godwin's *A Vindication of the Rights of Women* (1792) argued for woman suffrage. The demand was also raised by the Chartist movement in the 1840's. Soon afterward reports of suffrage agitation in the United States reached England. An article by Mrs. John Stuart Mill in the *Westminster Review* in 1851 created widespread interest.

The first woman's suffrage committee was formed in 1865 in Manchester. Two years later, John Stuart Mill presented to Parliament a petition signed by nearly 1,500 people, including Florence Nightingale, Frances Power Cobbe, Josephine Butler, Harriet Martineau, and Mary Somerville, calling for equal suffrage for women. An amendment to this effect to the Reform Bill of 1867 was lost, 73 in favor, 196 against.

Following the defeat of the amendment, numerous local woman suffrage societies were organized in England and Scotland, followed by the formation of the National Union of Women's Suffrage Societies under the leadership of Millicent G. Fawcett. From 1867 on, the movement in Britain and Ireland never ceased. In 1869, Parliament granted the municipal franchise to women taxpayers. The first separate bill for woman suffrage was introduced in 1870.

During the 1880's, although a majority of the House of Commons was in favor of women's suffrage, the government, whether Liberal or Conservative, prevented a final vote from being taken. While women were made eligible to become mayors and to sit in city and county councils, progress was slow in the major areas. After many delays and defeats, an increasing number of women were ready to follow Emmeline Pankhurst and her daughter Christabel in efforts in the early 1900's to organize women for more dramatic action. The Women's Social and Political Union, of which they were leaders, adopted militant methods, which became more violent as government opposition grew. When World War I broke out, the suffrage societies placed their well-trained forces at the service of the government and carried on what was probably the best organized work anywhere of women during the war. The need for reform in the franchise laws was recognized at last by members of Parliament from all parties. The Representation of the People Act was passed by the House of Commons in June 1917 and by the House of Lords on Feb. 6, 1918. It conferred the complete franchise, at the age of 30, on all women in Britain and Ireland. In 1928 the age was reduced to 21, and women voted on the same basis as men.

#### DEVELOPMENTS IN OTHER COUNTRIES BEFORE WORLD WAR II

Although the woman suffrage movement originated in the United States and Britain, its first successes were achieved in two of the British Dominions and in Scandinavia. The first country to grant women equal suffrage with men was New Zealand (1893), followed by Australia (in federal elections) in 1902. Women in South Australia could vote in state elections in 1894, and in Western Australia in 1899. The franchise in state elections was granted in New South Wales in 1902, Tasmania in 1903, Queensland in 1905, and Victoria in 1908.

**Scandinavia.** As in many other countries, women in Scandinavia gained the franchise by stages. Sweden first granted women the right to vote in 1863, though it was restricted to municipi-

pal elections and limited to unmarried women who paid a certain amount of taxes. Equal voting rights in municipal elections were granted to all women in 1918. The following year women gained the right to vote in all elections.

Finland gave widows and unmarried women local voting rights as early as 1865 and granted universal suffrage to women in 1906.

In Norway, women taxpayers were granted the right to vote in municipal elections in 1901. In 1907, women who voted locally could vote in national elections. Women were granted equal municipal voting rights with men in 1910, a right extended to national elections in 1913.

In Denmark women were granted the municipal franchise in 1907. When the new constitution was adopted in 1915, universal and equal suffrage was granted. In Iceland, women taxpayers voted in municipal elections in 1909 and took part in national elections from 1915.

**Other European Countries.** By the time of World War I, the movement to enfranchise women was finding new acceptance, largely through the work of the International Council of Women (1888) and the International Woman Suffrage Alliance (1904). The loyalty of women and the sacrifices made during the war years speeded the movement. Women were enfranchised in the Netherlands in 1917. Belgium granted municipal and communal suffrage to women in 1921; widows or widowed mothers of soldiers or civilians killed in action or imprisoned during the war were given the vote in national elections. Spain granted the vote to women in 1931.

World War I also hastened the enfranchisement of women in central and eastern Europe. Following the Russian Revolution of 1917, women were granted equal voting rights with men in the Soviet republics. In Luxembourg (1918) and Germany (1919) women were included in the electorate. In Austria, Czechoslovakia, and Poland women gained the vote in 1919, and in Hungary in 1920 (although with higher age requirements than men). In 1929, Romania and Greece granted women suffrage in municipal elections, subject in the latter country to higher age and literacy requirements.

**Canada.** In Canada the movement for woman suffrage was led by the National Suffrage Association, joined in later years by the National Council of Women. The great contribution made by women during World War I led in 1917 to the granting of the right to vote in provincial elections to women in active military service. The federal franchise was granted to women in 1918. The right to vote in provincial elections was first granted in Alberta, Manitoba, and Saskatchewan in 1916 and in Nova Scotia in 1918. In New Brunswick and Ontario, women gained the vote in 1919, in British Columbia in 1920, in Prince Edward Island in 1922, in Newfoundland in 1925 (although subject to a higher age requirement than men), and in Quebec in 1940.

**Latin America.** After World War I, the suffrage movement developed also in Latin America. When the franchise was won in the United States, women were not able to vote in any of the Latin American countries. The Inter-American Commission of Women, a specialized agency of what is now the Organization of American States, was organized in Havana, Cuba, in 1928 to work for the extension of civil, political, economic, and social rights of women of the Americas. Spectacular progress was made largely through the ef-

forts of the commission, led by Esther Neira de Calvo (Panama), its executive secretary. Other leaders in the woman suffrage movement in the Americas were Bertha Lutz (Brazil), Minerva Bernardino Coppá (Dominican Republic), and Isabel P. de Vidal Urdenata (Uruguay).

In Latin America, suffrage began with women taking part in local elections. Some women voted in municipal elections in the province of Santa Fé, Argentina, as early as 1921, provided they had a diploma authorizing practice in a profession, or if they administered their own estates. The right to vote in provincial elections was granted to women in the province of San Juan, Argentina, in 1927. In Mexico, women voted in state elections in San Luis Potosí and Yucatán in 1923, in Chiapas in 1926, in Guanajuato in 1936, and in Puebla in 1939.

In 1929, Ecuador became the first Latin American country to grant universal suffrage in national elections, with the restriction that it was obligatory for men and optional for women. When the women of Uruguay gained the vote in 1932 without any restrictions, they became the first Latin American women to be able to vote on the same basis as men. Brazil also adopted universal suffrage in 1932, followed by Cuba in 1934. Suffrage in municipal elections had been granted to Chilean women in 1931, subject to restrictions. Women in Peru won the vote in municipal elections in 1933.

**South Africa.** In South Africa the woman suffrage movement was limited to gaining the vote for white women. Municipal suffrage was granted to women in the Orange Free State in 1914. In Cape Colony, Natal, and Transvaal, women gained suffrage in 1919. The right to vote on an equal basis with men was gained in 1930.

**Asia and the Middle East.** During the period prior to World War II, the suffrage movement started to develop in Asia and the Middle East, though the religious tenets dominant in the area put serious obstacles in its path. In nations where a wife was but one of many, where girls were married at an early age, and where women were often considered little more than slaves, suffrage was difficult to achieve.

In 1930 women in Turkey won the vote in municipal elections, and in 1934 all restrictions were removed. In Burma some women voted as early as 1922; equal voting rights were granted in 1935. In 1932, Thailand became the first Asian country to establish universal suffrage. In 1937 the women of the Philippines gained the vote.

Changes occurred in India largely due to the leadership of Vijaya Lakshmi Pandit and the All-India Women's Conference. By 1929 women in seven of the nine provinces had obtained the right to vote in provincial elections; in 1935 the vote was extended to a limited number of women in national elections. Ceylon (Sri Lanka) granted women the right to vote in 1931, subject to higher age requirements than men. Equal voting rights were gained in 1934.

#### DEVELOPMENTS AFTER WORLD WAR II

After World War II, most of the remaining countries of the world granted the vote to women. There was a great change in public sentiment. The heroism and valor of women during the war years was rewarded by taking women into political partnership.

**United Nations.** The United Nations (UN) accelerated the worldwide movement to advance

the political rights of women. The UN Charter, signed in June 1945, was the first accepted international document that clearly defined equal rights for women. The preamble to the Charter contains the statement that the peoples of the United Nations are determined "to reaffirm faith . . . in the equal rights of men and women. . . ." There are eight references in the Charter to "without distinction as to sex." On Dec. 11, 1946, a resolution proposed by Denmark and unanimously adopted by the General Assembly asked all members of the United Nations, which had not already done so, to adopt measures to grant women the same political rights as men.

To implement the provisions of the UN Charter, the Commission on the Status of Women was established with the function of preparing recommendations and reports on promoting women's rights in political, economic, social, and educational fields. The commission proclaimed "as its first aim equal participation of women in government and the possibility for women to exercise all the rights and assume all the duties of citizens." The commission decided to give priority to the extension of political rights, since little could be achieved without them. Thus the commission became the new focal point for the worldwide suffrage movement.

In 1948 the Universal Declaration of Human Rights was adopted by the United Nations. It states that "everyone without distinction of any kind" is entitled to the rights and freedoms set down as "a common standard of achievement for all peoples and all nations." Article 21 states that elections "shall be by universal and equal suffrage. . . ."

Another UN action was the adoption of the Convention on the Political Rights of Women by the General Assembly on Dec. 20, 1952. The convention provides that women shall be entitled to vote in all elections and be eligible for election to all publicly elected bodies.

The United Nations declared 1975 to be International Women's Year and established 1975-1985 as the UN Decade for Women. It sponsored international conventions in 1975 and 1980 to assess women's progress in matters of education, employment, family planning, and health.

**Europe and Latin America.** Most of the remaining countries of Europe hastened to grant women the right to vote following the end of World War II. While the war was still on, Gen. Charles de Gaulle promised that the women of France would be granted the right to vote. This right was subsequently decreed by the provisional government in 1944 and confirmed by the constitution that was adopted in 1946, with both men and women voting. In the same year the women of Italy, Albania, Romania, and Yugoslavia were granted the full franchise. In 1948, Belgium followed suit. Women gained equal suffrage rights in Hungary in 1945 and in Bulgaria in 1947.

Partial victories were recorded in Portugal in 1945, where women received the franchise with restrictions; in Switzerland in 1959 and 1960, where women in the cantons of Neuchâtel, Vaud, and Geneva were granted suffrage in cantonal elections, and in Monaco in 1945, where women were granted the franchise in municipal elections. It was not until 1971 that Swiss women were enfranchised for federal elections; that year 11 women were elected to the parliament. Woman suffrage reached Andorra in 1970 and Liechtenstein in 1984.

The movement for woman suffrage spread across Latin America in the 1940's and 1950's. With few restrictions, women got the vote in the Dominican Republic in 1942, Guatemala in 1945, El Salvador and Panama in 1946, Argentina in 1947, Chile and Costa Rica in 1949, Mexico in 1953, Colombia in 1954, Honduras, Nicaragua, and Peru in 1955, and Haiti in 1957.

**Africa.** The achievement of independence in Africa brought with it equal political rights for women. In the countries formed from French West Africa and French Equatorial Africa, the right to vote was granted in 1946, without distinction as to sex, to persons who met specified statutory requirements. Universal suffrage was adopted in 1956 and confirmed by the first constitutions that were adopted after independence. In Tunisia and Morocco equal suffrage was adopted in 1959.

Similarly, in the former British colonies, suffrage was granted prior to the achievement of independence. In Ghana, for example, equal suffrage was granted in 1950 and confirmed by the 1957 constitution.

**Asia and the Middle East.** In Asia, political equality was viewed as fundamental to the development of independent nations. Even prior to independence, the nationalist movements recognized the need to enlist the support of women in their cause, and equal suffrage was a universal demand. Equal suffrage was written into the new constitutions of Ceylon (Sri Lanka) and Burma (1947), Indonesia and India (1949), and was adopted in Israel from the date of its independence (1948). In Pakistan the vote was granted to women in 1952 in provincial elections and in 1956 in national elections, largely due to the work of Mme. Liaquat Ali Khan, leader of the All-Pakistan Women's Congress. The vote for women was confirmed in Laos, Cambodia, and Vietnam in 1956 and in Malaya in 1957.

In the Far East, the women of Japan were enfranchised in 1946, in China in 1947, and in Korea in 1948. In the Middle East, however, women suffrage was slow to penetrate. In Iran limited voting privileges in municipal elections were adopted in 1949 and on the national level in 1963. Women first voted in Lebanon in 1952, if they had a primary education, and gained full suffrage in 1957. In Syria and Egypt women were granted suffrage in 1949 and 1956, respectively, but subject to certain restrictions not imposed on men. Other Middle Eastern countries followed suit in the 1960's, but women remained disfranchised in Kuwait. See also WOMEN'S RIGHTS MOVEMENT; WOMEN'S STATUS.

ESTHER W. HYMER

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**WOMAN'S CHRISTIAN TEMPERANCE UNION (WCTU)**, an organization of Christian women for the protection of the home, the abolition of the liquor traffic, and the triumph of the golden rule in custom and law. The National WCTU, whose headquarters are in Evanston, Ill., was organized in Cleveland, Ohio, in November 1874 as a result of the Woman's Temperance Crusade of 1873-1874. It now has approximately 250,000 members, organized in 6,000 groups in every state of the Union. The World WCTU has organizations in 72 countries of the world. Affiliated with the National WCTU are the Youth Temperance Council (ages 13-29) and the Loyal Temperance Legion (ages 6-12).

The organization publishes the *Union Signal* (monthly) and the *Young Crusader* (monthly), as well as many books, pamphlets, and leaflets. In addition to its work for the promotion of temperance and abolition of the traffic in liquor, it engages in extensive civic and philanthropic services. In Evanston, Ill., it maintains the Frances E. Willard Memorial Library for Alcohol Research, the second-largest library of its kind in the world. It also sponsors intercollegiate oratorical contests to stimulate research among college students on alcohol and related problems. The motto of the union is "For God and Home and Every Land." See also WILLARD, FRANCES ELIZABETH CAROLINE.

RUTH E. TOOZE

Former National President, WCTU

**WOMBAT**, wom'bat, a sturdy nocturnal Australian marsupial (family Vombatidae) that resembles a badger. It has a long but compact body, a very short tail, and short powerful legs with strong claws for digging. Its dense fur is gray or brown to black. Wombats spend the day in burrows that they dig themselves. Their chief food is grass, but they may also eat roots and bark of trees and shrubs. The wombat's voice is hoarse and growling. A single young is born about July and becomes independent within a half year.

The coarse-haired or common wombat (*Phascolomis* or *Vombatus*) lives in the coastal hills of southeastern Australia and Tasmania and was formerly found on the islands of Bass Strait. The soft-haired or hairy-nosed wombat (*Lasiorhinus*) may now be found only in the drier south central

A common wombat (*Phascolomis ursinus*) forages for food in winter snow in the Alps of southeastern Australia.

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coastal region of Australia. It has been killed off in many areas by campaigns to eliminate it as an agricultural pest. Campaigns to kill rabbits, the scourge of Australian agriculture, also took a severe toll of wombats, because rabbits often hide in wombat burrows.

A fossil genus of the Pleistocene epoch was as large as a hippopotamus.

TRACY I. STORER\*  
Author of "General Zoology"

**WOMEN IN THE ARMED FORCES.** Although civilian American women had served their country in the Revolutionary and subsequent wars, they were not officially allowed to join the U.S. armed forces until 1901, when Congress established the Army Nurse Corps. Women were first permitted to hold military rank in World War I. During World War II, women's reserve units were created for the Army, Navy, Marines, and Coast Guard. The Women Airforce Service Pilots (WASPs), a civilian unit, piloted noncombat aircraft. In 1948 the Women's Armed Forces Integration Act gave women permanent regular and reserve status in the Army, Navy, Air Force, and Marines. However, this law also limited the number of enlisted women and the rank they could attain. Not until 1973, prompted by the women's movement and the end of the draft, did the services actively begin to recruit women. In 1976 the military, naval, air force, and coast guard academies were opened to women. By the mid-1970's all the female auxiliary units had been dropped, and in general women were accepted into the military, trained, and paid on virtually the same basis as men.

**Air Force.** Women have been an integral part of the Air Force since legislation in 1948 established the women in the Air Force (WAF). Prior to that time, during World War II, 40,000 women known as Air Wacs served with the Army Air Corps and Army Air Forces. WAFs served with all major commands within the United States and in the majority of overseas areas. Women have since been integrated into the Air Force structure, and the term WAFs is no longer used. Women were first allowed to fly military aircraft in 1977, but by law they may not fly aircraft engaged in combat missions.

**Army.** In May 1942, Congress created the Women's Army Auxiliary Corps (WAAC) and authorized an eventual enrollment of 150,000. In 1943, Congress established the Women's Army Corps (WAC), replacing the auxiliary organization. Women now were detailed to almost every branch of the army. Legislation in 1948 made the WAC a permanent organization. The corps was dissolved in 1978, when women were incorporated into regular army units. Women are now employed in all noncombat occupational fields in the Army, Army Reserve, and National Guard.

**Navy.** Women were enlisted in the United States Naval Reserve for the first time during World War I. During World War II, legislation enacted in 1942 created the Women's Reserve of the United States Naval Reserve. WAVES (Women Accepted for Volunteer Emergency Service), as the Navy women were called, reached a peak strength of about 86,000 in August 1945. WAVES became a permanent part of the Regular Navy and the Naval Reserve in 1948. Navy women today are no longer referred to as WAVES.

Navy Nurse Corps, they are completely integrated into the Navy structure, but they are barred from serving on combat vessels.

**WOMEN'S BUREAU, Federal,** an agency of the U.S. government that promotes the welfare of women who work. An act of Congress created the bureau within the Department of Labor in 1920. The act was a response to concern about poor working conditions and low pay for women, many of whom labored for long hours in "sweatshops" within the garment industry. During World War II the bureau helped the country meet the need for industrial workers while men were in military service.

A sharp increase in the number of women who wanted to enter the work force in the 1970's posed a new challenge for the bureau, which focused its efforts on certain categories of workers. These included minority women and older women who were subject to discrimination, and newly divorced or widowed women who entered the job market because of financial need. The bureau also sought to help women entering fields traditionally dominated by men.

The bureau analyzes the effect of government programs on women, keeps track of relevant state and federal legislation, collects and publishes economic and legal data, and develops programs that serve as models for local communities.

**WOMEN'S CAUCUS, kó'kəs,** a nonpartisan organization of American women seeking equality with men in jobs at all government and political levels. The organization, whose full name is the National Women's Political Caucus, was founded at a meeting in Washington, D.C., on July 10–11, 1971. The caucus served notice that women would no longer be content with token offices and menial jobs, but it recognized that political power would not be given to them—they would have to take it.

In addition to an office in Washington, the caucus is organized at local and state levels to rally support for women candidates, to register new women voters, and to press all political parties to accept women in decision-making positions. It has established a set of guidelines for determining the candidates to support for public office, emphasizing the "elimination of sexism, racism, violence and poverty." The caucus' lobbying efforts have supported the passage of the Equal Rights Amendment and the protection of a woman's right to reproductive freedom.

Other priority issues include the enforcement of existing antidiscrimination legislation, improving the economic status of women, adequate housing and medical care for all Americans, the elimination of hunger and malnutrition, preservation of the environment, and the elimination of tax inequities involving women and children.

**WOMEN'S CLUBS, General Federation of,** an international women's organization founded in 1890. It was established to unite and promote the common interests of women's clubs throughout the world. It contains departments of the arts, conservation, education, home life, international affairs, international clubs, and public affairs. Membership numbers some 10 million women from nearly 50 countries.

The federation, whose headquarters are located in Washington, D.C., holds an annual convention and publishes *Clubwoman Magazine*.



The proposed Equal Rights Amendment to the U.S. Constitution became a hotly disputed women's rights issue.

**WOMEN'S RIGHTS MOVEMENT.** The late 20th century has been marked by a worldwide effort by women to gain rights previously denied them. The particular rights sought have varied from one society to another. However, economic rights, educational opportunities, and access to adequate health care are common concerns. Social freedoms and political participation are also widespread goals.

The women's rights movement is built on predominantly Western, 19th century efforts. Women bonded together to address grievances and needs before then, but records are scant and incomplete. Even less well known are the struggles of non-Western women.

During the 19th century, women focused first on gaining greater educational opportunities, then on legislation to ensure women's control of their earnings and property, employment rights, and the right to vote. The U.S. women's movement disintegrated after women won the right to vote in September 1919. See **WOMAN SUFFRAGE**.

Some issues, however, continued to command attention in the United States. In the 1920's, women were excluded from political-party participation. They turned to the League of Women Voters, a successor to the National American Women's Suffrage Association, to gain political skills and expertise. Birth control, promoted by Margaret Sanger, changed slowly from an illegal, socially unacceptable practice at the turn of the century to one that was common and neutral, if not good, by the 1960's. Women's participation in the work force remained stable in the 1920's but climbed thereafter. During World War II women were actively recruited to take over war jobs.

Despite postwar efforts to return them to the kitchen, women composed 27.9% of the work force in 1950 and 32.8% in 1960. The Women's Bureau of the U.S. Department of Labor, established in 1920, documented the needs of working women but received little attention until the 1960's.

**Organized Feminism—Vehicles of Reform.** The Women's Liberation Movement that developed in the 1960's in the United States stemmed from two sources. First, younger women involved in the civil-rights and student-dominated antiwar

movements found themselves treated as second-class participants. Often college educated and influenced by socialist ideals, these women analyzed their situation, found it oppressive, and became advocates of radical change. They usually formed local organizations, which then joined to form loose national networks, sometimes with international ties.

Second, business and professional women, frustrated by and angry with the barriers they encountered, established NOW, the National Organization for Women, in 1966. The failure of enforcement agencies to take seriously the provisions of the Civil Rights Act of 1964, which banned discrimination based on sex, was an important prod in bringing the organizers together.

WEAL, the Women's Equity Action League, focusing on legal and economic issues, was established by former NOW members in 1968. Working-class and ethnic women, while claiming they were not feminists, organized around issues such as urban renewal. The network they formed became the National Congress of Neighborhood Women. Union women, often ignored by leadership, formed the Coalition of Labor Union Women (CLUW) in 1974. Feminist caucuses became a part of professional organizations. New churchwomen's organizations demanded expanded roles for women. By the early 1970's, most of the well-established national women's organizations had adopted one and usually more of the issues on the feminist agenda. The Equal Rights Amendment (ERA), once considered a radical cause, had the nearly unanimous support of these groups.

Consciousness-raising groups were widespread. Women's centers became common. Women examined their lives, and issues bubbled forth. These were identified and attacked with mixed success. Sexual harassment, wife abuse, and rape became public issues and then, slowly, punishable crimes. Research from a feminist point of view slowly gained legitimacy and eventually led to a new and positive perspective on traditional women's values. Newsletters and newspapers appeared. *Ms.* magazine, first published in 1972, was a commercial success and was followed by similar national publications. One indication of the diversity of issues that



emerged was the 26-plank Plan of Action adopted by the 1977 National Women's Conference. The conference, which attracted 20,000 participants, was sponsored by the U.S. government as America's part in the United Nations Decade for Women (1975-1985).

**Ideological Differences.** Despite the growth of the movement, significant divisions emerged among women. Generally, issues related to fair-employment practices, education, and political participation united women, but family and sexually related concerns, especially abortion and lesbianism, polarized women. Since many ERA supporters favored the right of women to choose an abortion, the two issues were soon linked. From the mid-1970's onward, strong antiliberation forces acted to stop passage of the ERA and pass legislation prohibiting abortion.

The movement itself became divided over tactics and style. Every group, whether traditional or radical feminist, educated its members and, on occasion, mobilized them for political participation. NOW, with an activist stance, combined these activities with marches, rallies, and involvement in political campaigns around the ERA and, at times, abortion rights. Smaller groups, often ad hoc, chose fasting and civil disobedience to call attention to their goals. These tactics usually were opposed by mainstream women's organizations.

All the groups within the women's movement have tended to see themselves as feminist, yet important, though often blurred, ideological distinctions obtain among them. In broad terms, groups like NOW and the traditional women's organizations have sought to share in the society as it is structured and expect some, but not many, changes. Marxist feminists have blamed women's problems on capitalism and a class-structured society and advocate an end to capitalism. Separatists, often lesbians, have claimed that women's situation will change only if women withdraw from male-formed structures. Radical feminists have seen women's situation as the result of biology and seek to change women's status through biotechnology and fundamentally restructured families and communities. Many socialist feminists have agreed with important elements of both the radical and Marxist critiques. However, they have advocated fundamental societal changes that will accommodate women's biological and social roles.

In the late 1970's and early 1980's most of the movement's organized activities were directed to the passage of the ERA. With the failure of the ERA to win ratification by 1982 and increased anti-abortion efforts, activists began to reevaluate their strategies. The failure of the movement to attract significant numbers of minority and poorer women was an important element in this analysis. Another factor was the desire of many women to combine feminism with some of the more traditional women's values.

**Issues.** The women's movement in the United States is composed of both national organizations and networks of local groups. The multi-issue agenda includes the ERA, equal pay for work of equal value, protection of gains, and equal participation in decision-making in every aspect of society. Increasingly, women are turning to political action to achieve these goals.

**Politics.** For advocates, the ERA is the constitutional underpinning that would ensure that women could not be discriminated against. Op-

ponents, such as the Eagle Forum, believe that the amendment would allow abortion, undermine the traditional family, and remove necessary protections for women. See also **EQUAL RIGHTS AMENDMENT**.

The ERA struggle demonstrated women's lack of political power. The amendment often became hostage to other issues. As a consequence, women's political participation increased. Census returns for 1982 indicated that 64.4% of all registered voters were women. By the 1980's, women had gained access to almost every public office. In 1981, Sandra Day O'Connor became the first woman to sit on the U.S. Supreme Court. The first woman vice-presidential candidate, Geraldine Ferraro, was nominated in 1984.

Surveys often reported a difference in the opinions of men and women on some social and political issues, particularly those involving war and peace. Not until the 1980's, however, did this "gender gap" become a significant political issue.

**Education.** The pursuit of equality in education followed two main tracks: increasing women's opportunities and changing the content of educational programs. Pressure from women's organizations such as WEAL resulted in Title IX of the Education Amendments of 1972, which prohibited discrimination based on sex in educational activities and programs funded by the federal government. Because of administrative regulations, court decisions, and local campaigns, Title IX in practice came to mean that if an educational institution accepted federal funds, all institutional discrimination had to end. This interpretation of Title IX was challenged when the Supreme Court ruled in *Grove City College v. Bell*, 1984, that Title IX was "program specific." Pending further clarification, many feared that only those programs receiving federal funds would be nondiscriminatory.

Programs have been developed to enable older women to start or return to college. Publicity and peer support as well as legal action have enabled more women to take advantage of vocational education and training for employment in higher paying, traditionally male-dominated fields.

Women's rights advocates have also worked to change teaching methods and materials. Feminist educators developed programs designed to enable teachers and administrators to become conscious of and change discriminatory practices. Courses and study material designed to demonstrate women's contributions to all spheres of life have been prepared.

**Employment.** Women's participation in the work force grew from 23 million in 1960 to over 49 million (53% of all women 16 and over) in 1984. During that time, women moved to overcome discrimination in employment opportunities, unequal pay and benefits, and unsatisfactory working conditions. Women have organized; built and used the resources of organizations such as the NOW Legal Defense and Education Fund; called for assistance from government agencies such as the Equal Employment Opportunity Commission (EEOC) and the U.S. Commission on Civil Rights; instituted law suits; and lobbied for necessary legislation.

Substantial progress has been made in eliminating requirements for skills or characteristics not essential for job performance. Legal action

and changing attitudes have increased the variety of positions open to women.

Women workers found that benefits packages might provide for discretionary surgery for men but deny pregnancy benefits to women. After a 1976 U.S. Supreme Court decision allowed the exclusion of pregnancy benefits from employee health benefit plans, Congress responded to the resulting outcry by passing the Pregnancy Discrimination Act of 1978, assuring some women of pregnancy benefits.

Women who are mothers have acted to create working conditions that recognize their multiple roles. Among the strategies devised, flexible work time, though still limited in scope, is becoming more common. Other strategies such as job sharing are looked upon as experimental or unrealistic.

The issue of equal pay for work of equal value is on the agenda for future action. Using standardized training and responsibility criteria, advocates have found substantial discrepancies in the salaries paid men and women for positions with similar scores. In *County of Washington v. Gunther* (1981), the U.S. Supreme Court ruled that women could sue for wage discrimination without having to prove that they were denied equal pay for jobs identical to those of their male co-workers. However, the Court declined to address specifically the comparable worth issue.

**Abortion.** Abortion has presented a particular challenge to the women's movement. This issue not only has mobilized the conservative opposition to the movement, but it has also divided the movement. In addition, the nature of the public debate has polarized the debaters, making little allowance for compromise.

With the 1973 U.S. Supreme Court decision in *Roe v. Wade*, the focus of activity shifted from the state to the federal level. Opponents, including the National Right to Life Committee, have sought to prohibit or limit abortions both directly and through the cutoff of federal funds. Proponents, including the National Abortion Rights Action League, have sought to maintain the status quo. Proponents have prevented the passage of legislation restricting abortion per se. Opponents have progressively restricted public funding, until by 1984 funding was available only if a woman's life was endangered.

**Birth Control.** During the early years of the women's movement, feminists sought successfully to end laws that restricted access to effective contraceptives. The debate then shifted to issues of health and safety. The contraceptive pill, first marketed in 1960, ushered in the sexual revolution.

Feminists continue to press for adequate testing of contraceptives with attention to the health effects of long-term use; the development of alternative, more convenient contraceptives; and the development of a chemical contraceptive for men.

**Child Care.** Adequate and affordable day care is a concern of many feminists. It is one issue that draws together women and men, feminist and nonfeminist alike. Experts believe that 6-7 million children go without care for a significant part of the day.

Inasmuch as children's needs vary with age, quality is difficult to define. In response to needs, some states certify home-based centers that usually provide care for six to eight very young children. Certification for larger centers

is a common requirement. Increased reports of child abuse in care centers indicate that evaluation criteria are inadequate.

Costs for center-based care can be prohibitive for some families. The cutback in Title XX of the Social Security Act funds in 1981 forced many low-cost centers to close. Due to the work of organizations such as the National Women's Law Center, some of the cutbacks have been balanced by increased tax credits.

Pointing out that adequate day care contributes to worker productivity, child-care advocates work to expand business involvement. Since child care as a benefit to employees can be treated as a tax credit to employers, more businesses are encouraged to establish on-site centers or voucher payment plans.

**Family Life.** As women took greater control of their lives, many assumptions about the relationships between men and women and family roles were challenged. Seeking a larger public role for themselves, women insisted that men take on more responsibility for caring for children and maintaining a home. Women's increased workforce participation increased their self-confidence.

For many men this was a difficult time, as the assumptions they took for granted were being attacked. Many made some effort to change, but others refused. Women learned to express their anger and also began to voice their own sexual needs. Marital tensions grew, and when they could not be resolved divorce often followed.

A slight drop in the divorce rate from a high of 5.3 per 1,000 population in 1981 was one sign of a renewal of family life. The increasing acceptance of feminist values by men and a renewed appreciation among women of traditional feminine values contributed to this new attention to family life.

**Language and Media.** Aware that language and media influence ideas about women, feminists have tried to change both. They have sought the use of gender-neutral or balanced language, with mixed success. Efforts to introduce new words, especially pronouns, have generally failed. The use of Ms. as an alternative for Mrs. or Miss is an exception.

An early campaign, which included a lawsuit, forced newspapers to drop gender designations in help-wanted advertisements. Women's complaints to advertisers and networks have resulted in some changes in the images of women in TV advertisement and programs.

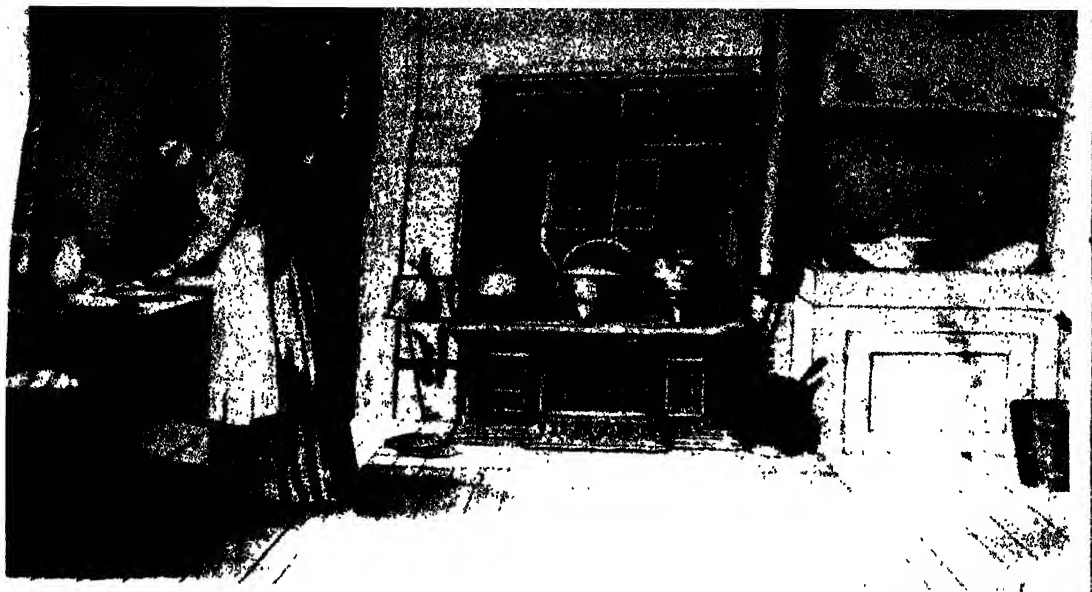
The belief that issues primarily of importance to women are underreported in the media has been confirmed by studies. Despite the availability of adequate information, such issues have been ignored or inadequately reported. Many advocates of fairer reporting of women's concerns believe that the situation will change only when there are more women in decision-making positions.

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The Women's Movement"

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THE BETTMANN ARCHIVE, INC.

Despite legal and social gains in the 19th century, women were generally considered to belong in the home.

**WOMEN'S STATUS.** Traditionally, women and men alike have accepted the fact that men have rights that women do not. Male behavior has been considered the norm, and women have been viewed, to some degree, as inferior. These attitudes are part of the stereotypes that shape thinking about women and women's behavior. Ultimately, they help determine women's status in society.

Through history, women have been labeled physically weaker than men, more emotional, less reasonable, less able to learn, and dependent. Although responsible for instilling civic and religious virtue in children, they themselves have been seen as susceptible to sin. Social customs and laws were developed to ensure that women fit these definitions. The occasional woman who did not conform was explained away or, more often, labeled a witch or a prostitute and punished.

Some of the stereotypes stem from women's childbearing, which, since it often was accompanied by poor nutrition, was debilitating. Nursing and child rearing have restricted women's activities. Childbearing alone, however, does not fully explain the pervasiveness of women's secondary status.

Whatever the sources, stereotypes and the attitudes they reflect are effective barriers to the changing of women's status. For this reason, many feminists have sought to identify and confront some of the more hurtful stereotypes.

Women have been defined as economically dependent, as homemakers and consumers, but not as producers. However, records show that women have always had economic roles. As farmers, fabricators, and service providers, they have contributed to both household and market. The failure of societies to acknowledge women's contributions has not only undermined women's status, but denied them necessary resources. In some developing nations even today, for example, women account for up to 80% of all agricultural production, yet they do not have ready access to new seeds, technology, or training.

Societies' needs and modern research are undermining some stereotypes. For example, the

need for mathematically competent workers has helped focus attention on girls' poor mathematical achievements. Studies indicate that mathematical and verbal abilities are linked to gender. However, the efforts made to accommodate the tendency of boys to be slow in acquiring verbal skills have not been matched by efforts to assist girls in acquiring mathematical skills. Furthermore, mathematically competent girls often have been discouraged from developing their skills.

Women's public decision making has often been dismissed as illogical, emotional, and subjective. Men's, on the other hand, has always been considered logical, rational, and objective. Psychologists and human-development specialists are accumulating evidence that women and men do tend to make decisions differently. Men tend to rely on objective standards, while women tend to pay much more attention to the impact of decisions on relationships. Researchers believe these differences are both inherent and the product of socialization.

The process of changing stereotypes and raising the status of women is slow and uneven. While the gains made by women in the United States generally are not matched by women in developing countries, they encourage changes in other places. The shift in societal roles because of economic changes, including economic development, also leads to an improvement in women's status.

#### HISTORY

In surveying the status of women through history, some common characteristics emerge. Women's status varies with both class and culture; no matter what the situation of elite women, poorer women have had to work hard and have received few societal benefits. Women make gains during periods of change, but these gains are not always secure. Finally, what is known about women is often based on the records and thoughts of men.

**Ancient Greece and Rome.** Women's status in the Western world has been shaped by Greek and Roman thought and by the Jewish and Christian religious traditions. In the world of classi-

cal Greece and Rome, men who were citizens had public responsibilities, and women were to bear children and manage households. In both cultures, poor women found ways to add to the family income, and peasant women worked in the field. However, significant differences existed between the two societies in the lives of citizen women.

In Athens, women were considered inferior to men. Although Plato argued that the most able women should be trained and educated to be leaders, the prevailing view followed Aristotle's belief that women should be passive, obedient, and silent. Ideally, women left their homes only to attend funerals and some religious celebrations. Legally minors, women had no control over the property that they could own and inherit. Wives were usually less well educated and significantly younger than the husbands who were chosen for them. Women did have a right to the return of their dowry if divorced, and they gained some independence with age.

Through time, Roman women gained the right to attend public functions and to conduct their own personal and business affairs. All but the poorest women received some formal education, and many elite women educated their own children. Although without political rights, some women wielded considerable political influence and, by the start of the Christian era, were having a say in the choice of emperor.

Prostitution was common in both Greece and Rome. Prostitutes had less restrictions than wives, and it has been suggested that some Roman women probably registered as prostitutes in order to gain freedom. The experience of slave women varied considerably. Some were intimates of their owners. Others received wages for their work, differing from their neighbors only by label. Still others were economically and sexually exploited.

**Early Jewish Society and Early Christianity.** Women in traditional Jewish society were viewed as wives and mothers. Ideally, they managed the household to increase its productivity and value. They could inherit property, but their contracts could be disallowed by fathers or husbands. Women were responsible for the religious training of their children yet had no public religious role.

Polygamy and divorce were allowed. Men and women were punished for adultery, women more severely. Menstruating women were avoided as unclean. Generally, men did not even talk with women who were not part of their families. Nevertheless, women were at times leaders, and wise women were respected.

Christian doctrine both praised women and blamed them for Adam's fall. Jesus welcomed women as well as men as followers. Saint Paul of Tarsus accepted women as spiritual leaders, but he taught that women should be subordinate to their husbands and should not preach or teach. Christianity held that though women were spiritually equal to men, practically, they were inferior and even sources of sin. Thus, virginity, first advocated as an opportunity for serving the church, became a means of avoiding sin and, in the case of men, avoiding women.

**The Middle Ages.** Christianity provided women with an acceptable alternative to marriage—religious communities. Originally informal groups gathered around a leader, by the 6th century these communities had become structured insti-



Changing needs of society affect women's roles. In World War II, women ordnance workers were actively sought.

tutions. Often established and supported by royalty, monastic communities gave women an opportunity to learn and to live a secure life amid the turmoil of the Middle Ages. Many abbesses, often women from upper-class families, became important civil as well as religious leaders.

As the Roman Empire disintegrated, women's status dropped. In the small states of Western Europe, women had few if any legal rights and, aside from the monasteries, no opportunities for education. However, the upheavals and wars of the Middle Ages left women with responsibilities for family and household, and some women began to sign contracts and appear in court.

**Renaissance to the 18th Century.** Beginning in the 15th century, women in the West have slowly gained rights and freedoms. In most instances, necessity forced women to change their behavior, then attitudes and laws acknowledged the changes.

Probably only a minority of women matched the societal ideal of mother and faithful wife. Most women were mothers but many poorer women probably did not marry. The legal and societal concerns with adultery and illegitimacy suggest that even among propertied persons, women's faithfulness in marriage was not taken for granted. Laws and attitudes supported a double standard.

Women as well as men shared in the learning of the Renaissance: learning, it was held, led to virtue. Educated women such as Isabella of Spain and Elizabeth I of England have been judged outstanding leaders by their peers and by history. Still, women were considered inferior, and the distribution of both education and power was narrow.

Trade, industry, and changes in agriculture drew people to towns and cities. Laws limited women's rights, but more women in trade and business signed contracts, managed property, and acted as their own agents. The shortage of



Women of developing nations often are responsible for cultivating crops in addition to rearing children.

work in the early stage of the Industrial Revolution resulted in pressures to limit women's work. Laws and guild regulations denied women access to apprenticeship programs. Nevertheless, women crowded into the growing cities and towns. Middle-class women could withdraw from the work force, but poor women were forced to accept harsh working conditions and low wages to survive. Young women were on their own; older women were often responsible for children. In Europe, the common age of marriage climbed from 21 to the current 25 to 28. Independent women—single, widowed, or abandoned—risked being put to death as witches, especially if they were healers.

Despite the barriers, education spread, in part because some Protestant sects held that everyone should be able to read the Bible. Migration to the colonies afforded women initial freedoms but also involved great peril. At the same time, women in England and elsewhere joined in political causes, the new nonconformist religions, and other social movements.

**Gaining Rights.** In the 17th century an occasional woman, often unmarried, spoke out for women's right to an education and a fair share of society's benefits. However, it was not until the late 18th century that women began to organize around their own concerns. Meanwhile, Rousseau and the Romantics held up the picture of women as fragile, domestic, and dependent.

In 1839 the Custody of Infants Act in England separated and divorced women custody of children under seven. Divorce reform came next in 1857, then property protection in the 1870's. In the United States, efforts to expand women's educational opportunities were suc-

ceeded by campaigns for legal reform. The suffrage movement followed. In northern Europe, meanwhile, women organized around issues of concern to unmarried mothers. By the mid-1920's, women in northern Europe, including England, and in the United States had the right to vote. Most women received at least a primary education.

**Other Parts of the World.** The history of the shifting status of women beyond the West is less well known. History and oral traditions name women leaders, in the Byzantine Empire and in India, for example. Other traditions identify women's roles and expertise; some suggest that women's roles, if not the individuals who filled them, were respected. The majority of the world's women have been workers as well as childbearers. Often, contact with the West increased their burdens. Western colonizers not only disdained indigenous people and customs, they failed to recognize women and their activities. African women farmers lost land rights when European-inspired laws required deeds to have a male owner's name. The education gap between women and men increased as boys gained access to Western-modeled education systems and girls did not. This was especially true in Islamic nations, where custom required that females be confined to the household.

The U.N. Commission on the Status of Women was established in 1948. It initiated plans for International Women's Year (IWY; 1975). Together with the U.N. Decade for Women (1975–1985) and the three U.N. Conferences related to the Decade (Mexico City, 1975; Copenhagen, 1980; and Nairobi, 1985), IWY represented the first worldwide effort to enhance the status of women. It raised questions about women's status before national and international decision makers. The Decade provided the occasion to meet some of women's basic needs, publicize women's many contributions, gather needed data, and organize and empower women. Many nations established national mechanisms to promote women's interest.

#### CONTEMPORARY STATUS OF WOMEN

**United States.** The decision of the Democratic party to name a woman as a vice-presidential candidate in 1984 is one indication of the improved status of women in the United States. Long active as party workers, women gradually began to receive influential political positions. The number of women in public office tripled between 1973 and 1984.

**Legal Gains.** The change in women's political status has been matched by changes in other areas. Despite the absence of an Equal Rights Amendment (ERA), women have gained many legal rights. Since the early 1970's, Supreme Court rulings based on the 5th and 14th Amendments of the Constitution have prohibited sex-based distinctions on the part of government, except when they "serve important governmental objectives. . . ." (*Craig v. Boren*; 1976).

Court rulings have been accompanied by legislation giving women more rights, benefits, and public responsibilities. Reforms in federal tax laws have eliminated estate and gift taxes on transfers of property between spouses. It was assumed until the 1970's that property registered in a husband's name was solely the result of his efforts. Therefore, wives paid higher estate taxes than their husbands would have paid. Re-



forms enacted in 1976 allow homemakers to establish Individual Retirement Accounts and provide for tax deductions for child care. Later legislation protects the pension and social-security rights of women whose benefits are based on their spouse's earnings. Lifelong homemakers, however, are not directly covered by Social Security.

Federal laws prohibit credit discrimination. State laws excluding women from jury duty were held unconstitutional, as were practices that discriminate against women in the rental or sale of property. Laws requiring that a woman's domicile be that of her husband's were overturned, and court rulings have supported women who keep their own name in marriage.

**Employment.** Legislation, agitation, and determination have removed many, but not all, employment barriers. The Equal Pay Act of 1963 and the Civil Rights Act of 1964 provide for equal treatment of men and women. Title II of the Education Amendments of 1976 and the Job Training Partnership Act of 1982 enabled women to compete for nontraditional jobs. A combination of legislation and court rulings prohibits discrimination because of pregnancy, protects women's job security when they take leave because of pregnancy, and eliminates other restrictions unrelated to the specific job.

Statistics reveal that many women have taken advantage of the opportunities available. The percentage of women becoming lawyers, economists, postal mail carriers, and machinists at least doubled between 1975 and 1985. According to the Women's Bureau of the U.S. Department of Labor, 22% of all working women in 1984 had better paying, managerial, and professional jobs.

Despite these advances, however, three fourths of all women in the work force are employed in women-dominated, low-paying, service, clerical-administrative support, and sales jobs. The reasons for this discrepancy are many. Women are often judged by stricter criteria and harassed if they move to new roles. Women's expectations and attitudes about work and the job preparation they receive are also factors. Women are still underrepresented in many training programs. In July 1982 the Department of Labor reported that women accounted for only 6% of all registered apprentices.

**Education and Research.** Educational opportunities for women in the United States have expanded considerably. In 1981, women earned just under half of all B.A.'s and half of M.A.'s granted. However, women earned only 31.1% of all Ph.D.'s and 25.2% of all first professional degrees. Significant differences exist between the secondary-school mathematics and science education of boys and of girls. These differences, like those between women and men in job training and apprenticeship programs, limit the future employment potential of girls.

Questions raised by feminists and the research interests of feminist scholars have stimulated the development and growth of women's studies. Looked upon with much skepticism when first introduced, the field of women's studies has become a respected interdisciplinary area of study in many colleges and universities.

As women have gained status, they have influenced research practices, stressing the importance of gender as a category in tabulating data. Medical, psychological, and developmental dif-



G. L. T. RHODIS TAURUS PHOTO

Legislation and changing attitudes have enabled women to compete for jobs in such nontraditional areas as carpentry.

ferences between men and women, previously ignored or explained away to the disadvantage of women, are now carefully examined.

Despite the education and research gains made by women, barriers remain. New research findings are integrated into curricula very slowly. Sex-role stereotyping still influences the courses and career counseling offered young people. Subtle discrimination as well as negative social attitudes, lack of successful role models, and inadequate preparation serve as barriers to women's entering into fields such as engineering and business.

**Family Roles.** Family roles are also changing, although the rate of change is slower. Decreasing family size has contributed to and enabled other changes. The average age at which American women marry for the first time has risen to 22. An increasing number of women are having their first child after age 30. At the same time, women are seeking to integrate tradition and equality in ways that support both women and families.

Modern American men commonly share in child care and other household tasks. However, evidence indicates that men's child care tends to center on the more pleasurable activities, such as recreation. The husband's contributions in the household usually do not match the wife's, even if both work outside the home. Women, even those who work, balance their usually lesser economic contribution by being primarily responsible for the smooth running of the household. As a consequence, women's total work day tends to be longer than men's.

**Violence and Poverty.** Amid the positive indicators of women's increased status are two impor-

tant negative ones. The incidence of violence against women, including rape and wife abuse, is high. Even if the increased willingness of women to report rape and abuse is taken into account, violence against women seems to be increasing.

Poverty is also a women's issue. The number of single-parent, female-headed households grew from 10.8% to 18.8% of all families between 1970 and 1981. Female-headed households accounted for over half of all poor families in 1981. And despite the advances made in protecting pension and social-security rights of women, more women than men over age 65 have incomes below the poverty level.

**Other Countries—Europe.** Scandinavian countries have done much to promote the status of women. Laws, for example, provide for paternity as well as maternity leave. Still, changes in traditional roles are slow. In other parts of Western Europe, women are primarily homemakers and mothers. Women in the work force are usually paid less than men. Cottage industries provide more women with the opportunity to earn an income, but this practice raises many questions about increased exploitation of women.

In Eastern Europe, an official policy of equality is contradicted in practice. Usually, women who are in the work force full time receive no household help from their husbands. Labor-saving appliances are few, and shopping especially is time consuming.

**Developing Countries.** At present, women in developed nations have acquired status close to that of men, though their gains are not secure. In contrast, most women in developing nations are still looked upon as inferior and are denied many social benefits. Educated, upper-class women occupy prestigious positions and have status. Poor women, especially rural women, are confined by traditional attitudes and structures. Although educational opportunities are available, barriers ranging from responsibility for younger siblings to fear of corruption from schooling prevent most girls from going to school. Training and informal education are enabling poor women to increase their family status through increased earnings.

The worldwide concern with socioeconomic development beginning in the 1950's has focused some attention on the role of women in the development process. Women bear a disproportionate burden in this process. Although the overwhelming number of women in developing countries are rural workers, a growing number are engaged in the assembly of electronic goods, toys, and appliances as well as in garment making. Rural women have lost traditional support systems as men migrate to cities, and they are often denied access to new resources. Industrial workers are hired in their mid-teens, work under adverse conditions, and lose their jobs by their mid-20's. The powerlessness of these women is shared by those women and children who constitute the bulk of the growing number of refugees.

MARY P. BURKE, *Author of "Reaching for Justice: The Women's Movement"*

**Further Reading:** Bell, Susan G., and Offen, Karen M., eds., *Women, the Family, and Freedom*, 2 vols. (Stanford Univ. Press 1983); Boulding, Elise, *The Underside of History* (Westview Press 1976); Moore, Lynda, *Not as Far as You Think: The Realities of Working Women* (Lexington Bks. 1988); Rothman, Sheila M., *Woman's Proper Place* (Basic Bks. 1979).

**WONDERS OF THE WORLD.** See SEVEN WONDERS OF THE WORLD.

**WONSAN**, wun'sān', a city in North Korea and capital of Kangwon province. Lying at the head of East Korea Bay, Wonsan has a fine natural harbor protected by a screen of islands. The sea and a mountain belt that lies behind the city have a moderating effect on the generally harsh climate. Wonsan is the center of North Korea's fishing (pollack, herring, cod, salmon) and fish-processing industries. It is also an important terminal for both maritime and domestic commerce.

The port was first opened to foreign trade in 1880, and rail lines linking Wonsan with Pyongyang and Seoul, as well as east-coast ports, were completed one after another from 1914. These facilities, together with Wonsan's industries (ship-building, oil refining, smelting, rice cleaning, brewing), were almost totally destroyed in the Korean War (1950–1953), but the city was rebuilt and new industries established (locomotive works, bricks, ceramics). Wonsan is a leading tourist and recreational center. Population: (1967 est.) 215,000.

EDWARD W. WAGNER, *Harvard University*

**WOOD, Anthony** (1632–1695), English antiquary and biographer. He was born in Oxford on Dec. 17, 1632, and attended Merton College, Oxford, where he received an M.A. degree in 1655. He then began his lifelong career devoted to the history of the university. Wood wrote his history in English, assisted by John Aubrey and others, and the newly founded university press agreed to publish the work, but only in Latin. It was translated with the help of John Fell, dean of Christ Church, and issued in 1674 as *Historia et Antiquitates Universitatis Oxoniensis*. The English version, *The History and Antiquities of the University of Oxford*, was not printed until 1792–1796.

Wood's chief claim to fame, *Athenae Oxonienses*, an account in English of distinguished personages educated at Oxford from 1500 to 1690, appeared in 1691–1692. Because of its criticisms of Edward Hyde, 1st earl of Clarendon, which were derived from Aubrey's notes, Wood was expelled from the university in 1693.

In his later years, Wood affectingly styled his name Anthony à Wood. He died in Oxford on Nov. 29, 1695.

**WOOD, Fernando**, American politician: b. Philadelphia, Pa., June 14, 1812; d. Hot Springs, Ark., Feb. 14, 1881. He was educated at a private school in New York City and prospered as a ship chandler and merchant. Active in Democratic politics as a member of Tammany Hall, he served in Congress (1841–1843) and, after being defeated for mayor in 1850, was elected in 1854 and 1856. He was at odds with the state legislature, which cut his second term in half, and was ejected from Tammany Hall in a patronage quarrel. Forming a rival organization, Mozart Hall, he won a third election as mayor in 1859. In January 1861 he proposed to the common council that New York secede from the state and become a free city, drawing its revenues from a tariff on imports.

Before the Civil War, Wood was pro-Southern in his views. When fighting began, he equipped

several Union regiments, but later he opposed the war. Defeated for reelection as mayor, he was sent to Congress in 1863 and was a spokesman for the Peace Democrats, calling for conciliation with the South. He was elected to Congress again in 1867 and served until his death. He spoke for the bankers and merchants, advocating a lower tariff and a refunding of the national debt. He was recognized as a leader of the minority party and after 1877 was majority whip and chairman of the Ways and Means Committee of the House. Wood was a brilliant and masterful political organizer, and many of his ideas on the subjects of administration, sociology, and economics were advanced for his time.

**WOOD, Gar** (in full GARFIELD ARTHUR WOOD), American speedboat racer and industrialist: b. Mapletown, Iowa, 1880. He earned a fortune from several of his inventions, notably a hydraulic hoist, and became chairman of Gar Wood Industries, Inc. One of the world's outstanding sportsmen, Wood was instrumental in popularizing speedboat racing. He won the most coveted American trophy for hydroplane racing, the Gold Cup, four times (1917, 1919-1921), setting a record in 1920 (70.0 miles per hour) which remained unbroken for a quarter century. Also in 1920, driving his *Miss America I*, he won the Harmsworth Trophy, and he repeated his victory in seven of the following eight international competitions for it. In 1932, he drove his *Miss America X* over a one-mile course at an average speed of 124.86 miles per hour, the United States record until 1949. After winning the Harmsworth Trophy with this craft in 1933, he retired from competitive racing. He died in Miami, Florida on June 19, 1971.

**WOOD, George Bacon**, American physician: b. Greenwich, N.J., March 12, 1797; d. Philadelphia, Pa., March 30, 1879. He graduated from the medical department of the University of Pennsylvania in 1818. He was a professor at the Philadelphia College of Pharmacy from 1822 to 1835 and at the University of Pennsylvania from 1835 to 1860, also serving as president of the American Medical Association in 1855-1856 and of the American Philosophical Society in 1859-1879. He wrote *Treatise on the Practice of Medicine* (1847) and, with Franklin Bache, *The Dispensatory of the United States* (1833), both of which were published in many editions. The University of Pennsylvania was endowed with an auxiliary faculty of medicine and was bequeathed a botanical collection by Wood.

His nephew, **HORATIO CHARLES WOOD** (1841-1920), was graduated in medicine from the University of Pennsylvania in 1862 and was professor there from 1866 to 1906. The author of hundreds of scientific papers, he worked in the fields of botany, entomology, nervous diseases, experimental medicine, and medical jurisprudence. His *Treatise on Therapeutics* (1874) became the standard English work on the subject, and in 1884-1900 he was the editor of the *Therapeutic Gazette*.

**WOOD, Grant**, American painter: b. Anamosa, Iowa, Feb. 13, 1891; d. Iowa City, Feb. 12, 1942. As a farm boy, he often took charcoal from the kitchen stove to draw on brown paper or a cracker box. After the death of his father in 1901, the family left the farm for Cedar Rapids, where Grant attended and completed high school. He

later studied under Ernest Batchelder at the Minneapolis Handicraft Guild for two summers, attended a few art classes at the State University of Iowa, and took night classes at the Art Institute of Chicago. In 1923 he studied at the Académie Julian in Paris. After returning to Iowa he received a \$10,000 commission in 1927 for a stained glass window to be placed in the Cedar Rapids Memorial Building. He produced the window in Munich, where the best stained-glass workers were to be found. While there, his interest in 15th and 16th century German and Flemish painting, in the 19th century realist Wilhelm Leibl, and in Otto Dix, a contemporary artist active in the *neue Sachlichkeit* or "realist" movement, enabled him to fix in his mind the hard, stylized but still realistic style in which he wished to work.

Grant Wood



Associated American Artists

His first paintings in the new style were *John B. Turner—Pioneer* (1929) and a portrait of his mother entitled *Woman with Plants* (1929, Cedar Rapids Art Association). In the fall of 1930 his reputation was established, almost overnight, by the Chicago showing of his *American Gothic* (1930, Art Institute of Chicago), a stark canvas which portrays an Iowa preacher-farmer and his daughter standing in front of a house with a Gothic window. In Wood's mind, these figures (for which his sister and his dentist had posed) represented not simply Iowa farm folk but the serious, sober, dependable small-town people who form the solid base of American life. In this respect, the painting was unlike his *Daughters of Revolution* (1932), a satirical work that was interpreted as a stab at smugness. It was intended to deflate those members of patriotic organizations who placed pride of ancestry above personal achievement.

Wood subsequently directed an Iowa Public Works of Art project and taught at the State University of Iowa, meanwhile continuing to paint and sell his works. Representative among the later canvases were *Dinner for Threshers* (1934, Whitney Museum, New York), *Parson Weems' Fable* (1939), and *Spring in Town* (1941, Terre Haute, Ind.). When cancer ended his life, on the eve of his 51st birthday, Wood was at the peak of his fame as a painter of the American scene.

FREDERICK A. SWEET,  
*Curator of American Painting and Sculpture, The Art Institute of Chicago.*

**WOOD, Mrs. Henry** (nee ELLEN PRICE), English novelist: b. Worcester, England, Jan. 17, 1814; d. London, Feb. 10, 1887. From her girl-

hood, she suffered from curvature of the spine, which partially invalidated her. After she married Henry Wood, a banker and consular official, in 1836, she lived abroad for most of the following 20 years and began her literary career by contributing stories to *Bentley's Miscellany* and the *New Monthly Magazine*. The most successful of her more than 30 novels, *East Lynne* (q.v.), appeared in 1861, and in 1862 appeared two other popular works, *Mrs. Halliburton's Troubles* and *The Channings*. In 1867, she became editor and proprietor of *Argosy Magazine*, where her "Johnny Ludlow" stories appeared. Though melodramatic and slipshod, Mrs. Wood's works are characterized by ingenuity of plot and vivid depiction of character.

**WOOD, Sir Henry Joseph**, English conductor: b. London, England, March 3, 1869; d. Hitchin, Hertfordshire, Aug. 19, 1944. After appearances as a musical child prodigy, he began conducting opera in 1889. His first series of Promenade concerts at Queen's Hall, London, began on Oct. 6, 1895. Becoming a popular feature of English musical life, they continued with brief interruptions for 49 years, his last concert being heard on July 28, 1944. Wood conducted widely elsewhere, composed under the pseudonym of Paul Klenovsky, and made successful arrangements of music for orchestra. In 1918 he refused an offer to succeed Karl Muck as conductor of the Boston Symphony Orchestra. He was knighted in 1911 and given an honorary degree of Doctor of Music by Oxford University in 1926.

HERBERT WEINSTOCK.

**WOOD, Jethro**, American inventor: b. March 16, 1774; d. Ledyard, N.Y., Sept. 18, 1834. He was born either in Dartmouth, Mass., or in White Creek, Washington County, N.Y., where his family settled before 1783. He married in 1793 and, about seven years later, moved to a farm near Poplar Ridge in the town of Ledyard, Cayuga County, N.Y. He first patented a cast-iron plow in 1814, but was not satisfied with it and patented a perfected plow on Sept. 1, 1819, a few months after Stephen McCormick's similar patent in Virginia. The cast-iron parts of Wood's plow were standardized and replaceable; the plow itself was light, had good balance, and was cheap to manufacture. Most important, perhaps, were Wood's improvements in the shape of the moldboard and other parts. His designs were widely copied in the northern states and contributed to the development of farming machinery.

JOSEPH H. JACKSON.

**WOOD, John**, English architect: b. Yorkshire, England, 1705?; d. Bath, May 23, 1754. Wood began his career as a roadbuilder, and it was not until 1728 that he exercised his gift as an architect in the construction of Wiltshire's Assembly Rooms, where the society of Bath gathered for breakfast before bathing. This initial success, furthered by Richard Nash, who wanted to establish Bath as a holiday center for the fashionable world, led Wood into a series of architectural creations in the city: the North and South parades (1728), Queen Square (1729), St. Mary's Chapel (1732), the Royal Mineral Water Hospital (1738), and Prior Park (1742), built for Ralph Allen of the local, honey-colored stone. Wood's architecture was classical in design and set a standard for the planning of streets and groups of buildings.

His son, JOHN WOOD, JR. (d. 1782), shared in his father's work and completed several plans conceived by the elder Wood: the Circus (1764), a circle of houses in Palladian style which sheltered such celebrities as the Duke of Bedford, the Earl of Chatham, Lord Clive, and Thomas Gainsborough; the Royal Crescent (1767-1769), a classical semiellipse of 30 houses with a coherent, pillared facade; and the Hot Bath and the Royal Private Baths (1776). From his own designs the younger Wood also constructed the buildings on three full streets: Kelston Park (1764), Alfred (1768), and Belmont (1770).

DONALD B. CLARK.

**WOOD, Leonard**, American soldier and administrator: b. Winchester, N.H., Oct. 9, 1860; d. Boston, Mass., Aug. 7, 1927. Wood grew up in the Massachusetts seashore village of Pocasset and attended Pierce Academy in Middleboro. He entered the Harvard Medical School in 1880, received an M.D. degree in 1884, and, after a brief practice in a Boston slum, joined the Army Medical Corps. Upon reporting for duty in Arizona, he immediately saw action in the successful campaign against the Apache chief Geronimo (1885-1886), not only as a physician but also as commander of troops, for which he later received a Medal of Honor. He served subsequently in California and in Eastern states, and in 1895 was assigned to Washington, D.C., where he was to become White House physician to William McKinley.

In Washington he also formed a close friendship with Theodore Roosevelt, who was then assistant secretary of the Navy. As members of the imperialist faction within the Republican Party, they brought pressure on President McKinley to declare war on Spain and, after the outbreak of war in April 1898, organized the First United States Volunteer Cavalry, popularly known as the Rough Riders. Commissioned a colonel, Wood took command, with Roosevelt second in command. The Rough Riders played a prominent role in the invasion of Cuba, and Wood's command was enlarged to include regular cavalry regiments at San Juan Hill. He won a battlefield promotion to brigadier general. After the capture of Santiago de Cuba, he was appointed governor of the eastern sector of the country. His success was such that he was promoted to major general of volunteers and, on Dec. 5, 1899, became military governor of all of Cuba, continuing in this post until the Cuban republic was established and power was transferred to an elected Cuban government on May 20, 1902.

Wood's energy and efficiency as governor attracted much favorable notice. He imposed sanitation measures, built sewage disposal systems, constructed highways and railway lines, and devoted one quarter of Cuba's revenue to the establishment of public schools. Reforming the judicial and electoral systems, he laid the basis for subsequent democratic government. When Walter Reed, then conducting research in Havana, discovered the cause of yellow fever, Wood began a campaign to eradicate mosquitoes. Decades later, the Cuban government was to show its appreciation of his services by voting a pension to his widow.

Early in 1903, Wood was assigned to pacify Mindanao in the Philippines. Appointed governor of Moro Province, he crushed opposition to American occupation and introduced Americanizing re-

orms, but he was criticized for the heavy death toll inflicted on the Filipinos, including women and children, during the course of his campaigns. In August 1903 he was made major general in the Regular Army, despite protests against the promotion of a "medic" over the heads of more than 500 officers. He was the commander of the Army's Philippine division from 1906 to 1908 and then returned to the United States, where he commanded the Department of the East (1908-1910, 1914-1917) and was chief of staff (1910-1914). When World War I began, he and Roosevelt campaigned for military "preparedness," established civilian officer training camps at Plattsburgh, N.Y., and criticized the administration of Woodrow Wilson for slowness in making war preparations.

After the United States declared war against Germany in 1917, President Wilson bypassed Wood in favor of John J. Pershing for command of the American Expeditionary Force. Wood organized and trained the 89th and 10th divisions but was summarily relieved of command on the eve of the departure of the 89th for Europe. He was awarded a Distinguished Service Medal, but Wilson's adamant refusal to let him take part in the fighting made Wood the hero of Wilson's bitter critics.

Wood was military in his bearing and conduct, loved strenuous physical exercise, possessed great energy and capacity for work, and was extremely ambitious. His public personality was not warm and expansive, but his courage, sincerity, and strength of conviction attracted a devoted personal following. When Roosevelt died in January 1919, Wood became his heir as the leading candidate for the 1920 Republican presidential nomination. His campaign speeches emphasized military preparedness and suppression of radicalism. While liberals were disappointed by his lack of a social and economic program, some businessmen contributed huge sums to his campaign. Wood refused, however, to accept the military hero's traditional role as a front man for professional politicians. He won victories in the primaries and led on the early ballots at the Chicago convention, but sternly rejected offers from Senator Boies Penrose and certain influential oil men to give him the votes necessary for nomination in exchange for the privilege of naming cabinet members. In the famous "smoke-filled room," the party regulars denied him the nomination and, instead, chose the complaisant Warren G. Harding (whose administration was clouded by scandal).

In 1921, Harding appointed him governor general of the Philippines. Advising that independence be postponed, Wood reversed the movement toward self-government with firm rule. He was largely successful in restoring public finances and improving economic conditions, but was bitterly criticized by independence forces. He died after his third operation for a brain tumor which had produced a pronounced limp at various periods of his life. In reporting his death, the *New York Times* called him "America's great pro-consul."

WESLEY M. BAGBY,  
West Virginia University.

**WOOD, Mary Elizabeth**, American librarian: b. Elba, N.Y., Aug. 22, 1861; d. Wuchang, China, May 1, 1931. While visiting her missionary brother in China in 1899 she became interested in Boone College in Wuchang and remained there

to work. She enlarged the college library, helped to establish traveling libraries, and in 1920 founded a library school at Boone. She also assisted in sending young Chinese to the United States for education.

In 1923 she began crusading for Chinese national libraries, working tirelessly in Washington to secure passage of a bill designating the unassigned portion (about \$6 million) of the Chinese Boxer Rebellion indemnity to educational and other cultural uses in China. Miss Wood spent the rest of her life enlarging the endowment of Boone and effecting various humanitarian projects on behalf of the Chinese.

VIVIAN PRINCE.

**WOOD, Robert Williams**, American physicist: b. Concord, Mass., May 2, 1868; d. Amityville, N.Y., Aug. 11, 1955. After graduating from Harvard University in 1891, he studied at the universities of Johns Hopkins, Chicago, and Berlin (1891-1896). He joined the faculty of the University of Wisconsin in 1897, became professor of experimental physics at the University of Johns Hopkins in Baltimore in 1901, and was research professor after his retirement in 1938. His work in optics and spectroscopy was especially important, and he conducted significant research on the physical properties and biological effects of ultrasonic waves, explored the properties of ultraviolet and infrared radiation, and improved diffraction gratings; he was awarded many medals for his work on the diffraction method in color photography. In World War I he was a major in the Signal Corps and originated a secret signaling system. He was a consultant during World War II for the Manhattan Project, which led to development of the atomic bomb.

His publications are quite diverse and include a book of illustrated humorous verse, *How to Tell the Birds from the Flowers, A Manual of Flornithology for Beginners* (San Francisco 1907; rev. ed., New York 1917); *Researches in Physical Optics*, 2 vols. (New York 1913-19); *Physical Optics* (New York 1905; rev. ed., 1934); and *Supersonics, The Science of Inaudible Sounds* (Providence, R.I., 1939).

**WOOD, Thomas John**, American soldier: b. Mumfordsville, Ky., Sept. 25, 1823; d. Dayton, Ohio, Feb. 25, 1906. He graduated from West Point in 1845, served under Gen. Zachary Taylor in the Mexican War, and remained active on frontier duty until the outbreak of the Civil War, rising through the ranks to a colonelcy in 1861. As a Union brigadier general of volunteers in 1862, he led an Indiana brigade and then a division. At Chickamauga in September 1863, the controversial removal of his division from the line opened the way for a Confederate penetration, but he redeemed himself at Chattanooga in November when his division spearheaded the capture of Missionary Ridge. Despite a severe leg wound suffered in the fighting around Atlanta in 1864, he continued commanding his troops and won high praise from Gen. William T. Sherman, the commander of the Union forces advancing eastward to the Atlantic coast. He was appointed major general of volunteers immediately after the war and retired from the Army in 1868.

**WOOD, Thomas Waterman**, American artist: b. Montpelier, Vt., Nov. 12, 1823; d. New York, N.Y., April 14, 1903. At the age of 23 he went



to Boston and studied under the portrait painter Chester Harding. In the years following, he practiced this art form in Quebec, Washington, D.C., New York City, and Baltimore. He went to Europe in 1858 for further study, remaining there for two years. From 1861 to 1866 he worked in Nashville, Tenn., and Louisville, Ky., as a portrait painter, then settled in New York City, where he became prominent as a genre painter. In addition to his New England scenes, Wood is remembered for his portrayals of the American Negro at the time of the Civil War. Three of his paintings, *The Contraband*, *Recruit*, and *Veteran* (composing a unit entitled *War Episodes*), are in the Metropolitan Museum of Art in New York. He served as president of the American Water Color Society (1878-1887) and of the National Academy of Design (1891-1899). The Wood Gallery of Art, which he founded in 1895 in his home town, houses his copies of European masters as well as some of his original works.

**WOOD**, the hard, fibrous substance between the pith and bark of trees. More specifically, it may be defined as the lignified, water-conducting, strengthening, and storage tissues of branches, stems, and roots of trees. Technically, it is known as xylem.

The chief product of the forest, wood is a universally useful raw material. From prehistoric times it has been used as a source of heat and as material for shelter and construction. As civilization advanced, it assumed major importance as material for boatbuilding, for piling to support docks, wharves, and piers, and for cross-ties to carry the world's railroad tracks. In modern times, with the advance of wood chemistry, wood's uses have become legion, extending to such varied and important products as paper, textiles, plastics, and hundreds of chemicals and extractives.

With the development of heat- and moisture-resistant glues, plywood and laminated wood have in some products superseded metallic and ceramic materials. Compressed wood has replaced some metals for gears and die casts. Wood's versatility has been demonstrated in Europe by its use in emergency wartime conditions as a source of wood gas for propelling automobiles. Similarly, clothing has been made from wood cotton and wood wool. Wood also provides material for the manufacture of animal foods.

Because it is renewable, is available at relatively low cost, and has such a variety of structural, ornamental, aesthetic, insulating, and chemical properties, wood is considered by many mid-20th century observers to be the most important raw material of the future, exceeding even the metals, oils, and rubber.

Wood properties, processing, chemistry, and products are discussed in the following sections:

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|--|--------------------------------|
| 1. Introduction                          | 3. Seasoning                   |
| 2. Properties                            | 4. Lumber and Related Products |
| Technical Properties in Relation to Uses | 5. Wood Chemistry              |
| Physical Properties                      | 6. Wood Chemistry Products     |
| Chemical Properties                      | 7. Bibliography                |

## 1. Introduction

There are two parts of the main stem of a tree: (1) the outer part, next to the bark, called sapwood, which is the living and physiologically active wood and is generally of pale color; and (2) the inner core, composed of nonliving cells, called heartwood, and generally darker in color.

The latter performs the function of support and has a lower moisture content and is generally harder and more durable than the sapwood. As a tree grows larger and older, the proportion of heartwood increases and forms a very large part of the stem.

All woods are classified for commercial purposes as: (1) softwoods, known also as conifers or evergreens, and (2) hardwoods, which are generally deciduous and have broad leaves. These are not classifications of hardness, since some hardwoods, such as basswood and poplar, are much softer than some conifers. The reverse is also true. There are more than 1,000 separate species of woods in the United States and Canada. Only about 60 are of great importance. The conifers, such as pines, firs, spruces, redwood, cedars, and cypress, produce most of the lumber used in construction, as well as many other forest products, such as pulp, paper, and plywood. There are more species of hardwoods than of conifers; the hardwoods are largely specialty woods, used primarily for furniture, flooring, paneling, cross-ties, handles, tools, and many other purposes. Oak, maple, beech, birch, red and black gum, yellow poplar, ash, basswood, black walnut, hickory, and black cherry are among the prominent and most useful hardwoods.

Trees grow in height and diameter each growing season by taking moisture and nutriment from the soil and elevating them to the leaves where, by a process known as photosynthesis, the chlorophyll converts them into food elements. These proceed down the stem and add a layer of wood known as the annual ring. Thus some trees may grow rapidly, depending upon climate, soil, moisture, and food elements, up to  $\frac{1}{8}$  to  $\frac{1}{2}$  inch in diameter per year or more; whereas some may grow at the rate of only  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in 10 to 15 years or more. Through scientific forestry, the objective is to grow timber crops of the better and more valuable species as rapidly as possible. This process is known as silviculture.

The wood of each species differs in its structure, fiber length, pores, color, and other characteristics. Under the microscope and especially when cut in cross section, these differences form the means of identification. However, the more common species can readily be identified without instruments by their appearance, weight, color, grain, and character defects, such as mineral stain, checks, knots, and pitch pockets.

**Advantages of Wood.**—The advantages of wood as a material may be summarized as follows:

(1) In proportion to weight, wood is stronger than other materials of wide availability and use, including steel.

(2) Wood is worked easily with tools and lends itself to manufacture and fabrication into many shapes, sizes, and designs.

(3) Wood is an excellent nonconductor of heat, so that it has a special value in making dwellings warm in winter and cool in summer. In cold climates, the frame dwelling, properly built and insulated, is the warmest type of home.

(4) Its grain and appearance render it susceptible to artistic and architectural designs—thus adding to the beauty and attractiveness of furniture, interior and exterior finish, paneling, flooring, and other items.

(5) Lumber is comparatively inexpensive—a further reason for its almost universal use for many structural purposes.

(6) Wood is abundantly available in many

shapes, sizes, and forms, and is a renewable resource. With the widespread adoption of intelligent forest management policies, ample supplies can be grown and are foreseeable for the future.

(7) The use of timber connectors in wide trusses and spans, towers, and general construction permits the utilization of smaller wood members, thus making some forms of timber construction very economical.

(8) Development of methods for making wood fire resistant, through impregnation of the fibers with a fire retardant, have increased wood's usefulness as a structural material, particularly for some interior construction. Wood is readily insurable at relatively low rates. Heavy timber construction, known as mill construction, enjoys a lower fire insurance rating than steel construction.

(9) Wood does not deteriorate in value if properly handled and protected.

(10) It is not readily affected by changing styles.

(11) It has a prompt resale value.

(12) Heat, cold, or climatic changes do not seriously affect it.

## 2. Properties

### Technical Properties in Relation to Uses.

Wood varies widely in its composition, structure, and technical properties. Some species, such as southern pine and Douglas fir, are strong, stiff, hard, durable, abundantly available, and relatively inexpensive. They therefore make excellent multipurpose construction timbers, lumber, crossties, and other products where these qualities are important. Douglas fir, occurring in large sizes, is also an excellent wood for veneers and plywood. The soft pines, particularly the white pine, Idaho or western white pine, sugar pine, and ponderosa pine, are very soft, even textured, close grained, and workable, and therefore are widely used for doors, sashes, boxes, interior finish, foundry patterns, and flasks. *Lignum vitae* is one of the heaviest and hardest woods, and is in great demand for bowling balls. Balsa wood, growing extensively in Ecuador and Peru, is even lighter than cork, and is widely used for some highly specialized purposes, such as airplanes and life rafts. Teak from Burma is regarded as the best wood for certain shipbuilding purposes, such as decking, because it seasons well and warps and twists very little. *Quebracho* wood from Brazil and Paraguay is another of the heaviest and hardest woods, and is used in South America for crossties and as a source of tannin to condition leather. Oak is hard and heavy, is the most important wood used for crossties, and makes fine furniture. White oak, being impervious to liquids and without disagreeable odors or flavor, is in great demand for barrels and other tight cooorage.

The cedars, cypress, and redwood, which are exceedingly durable, light in weight, and readily converted, make excellent siding, poles, exterior trim, shingles, posts, and even crossties for railroads on which traffic is infrequent or rolling stock light. Spruce has long, strong fibers, is relatively free from resinous and gummy substances, and therefore is adaptable for the production of pulp and paper. Yellow poplar is soft and workable and seasons well, and is popular for many woodworking and finishing purposes; it is also widely used for plywood cores. Basswood, which is light in weight, soft, white colored, and

possesses excellent working qualities, is used for fine quality boxes and for Venetian blinds, moldings, novelties, picture frames, and excelsior. Elm is tough and useful for such items as barrel hoops and hockey sticks.

Black walnut, black cherry, and mahogany season well, possess attractive figure, color, and grain, and are premier woods for furniture, interior finish, cabinetwork, and the like. Curly and bird's-eye maple are also specially prized as cabinet and furniture woods. Quartered oak, red gum, and sycamore present a striking and pleasing grain or silvery sheen which attracts premium prices. Willow is light in weight and makes a good artificial limb. Hickory is strong, tough, and pliable, and therefore makes some of the best skis. Ash is strong for its weight and straight grained, and makes excellent handles for rakes, hoes, and other tools, as well as baseball bats. The longleaf pine of the South yields a large amount of resin when tapped and is the source of rosin, turpentine, and other chemical products. The sugar maple provides a sap which is converted into sugar and a sweet sirup. The bark of the cinchona tree produces quinine. Rubber is obtained from the milky sap or latex of the rubber tree.

Each species varies widely in its growth rate, weight, and usefulness even within each tree. Cherry in some regions has excessive gum pockets, which tend to degrade the lumber and lower its value. Butt logs, or those cut from the base of the tree, contain in most species the best wood and are freest from defects. Therefore they yield the clearest and most valuable boards. Top logs may be of lower value because of excessive number and size of knots and other defects. Some species check and split readily on exposure to the air after manufacture or crosscutting. Sapwood differs from heartwood in its chemical composition, moisture content, and appearance. Sapwood in some species, such as redwood, western red cedar, catalpa, and yew, is relatively very narrow, whereas it is comparatively wide in such species as maple, ash, hickory, beech, and some of the pines.

Second-growth timber generally contains larger proportions of sapwood than virgin timber. In some species, such as willow, spruce, true firs, hemlock, and cottonwood, there is little difference in structure and appearance and, therefore, in value between sapwood and heartwood. The darker color of heartwood is generally due to the deposition of certain tannins, gums, resins, or other substances. Heartwood is more durable and generally contains a lower moisture percentage; consequently it is generally more valuable. For spools, handles, and spokes, sapwood is often preferred. Handles for such articles as hammers, axes, shovels, and rakes are preferred from second-growth ash and hickory. Sapwood takes preservative treatment more readily than heartwood—a factor of importance in crossties, poles, posts, piling, and other materials used in a treated condition. See also separate articles on the various species of trees.

**Physical Properties.—Strength.**—As applied to wood, strength is a general term used in reference to the ability of wood to resist certain stresses and strains. Different woods vary materially in these respects.

The principal resistant features that involve strength are:

(1) Resistance to compression along the fi-

best, as in pillars and dimension timbers in an upright position (exterior frames of buildings).

(2) Stiffness, or the ability to resist bending, as in floor joists and beams supporting heavy loads in all construction.

(3) Strength in tension, or the ability to resist in lengthwise stress. Wood is seldom put to this test.

(4) Shearing strength, or the ability of the fibers to resist rupture either with or across the grain, for example, the shear of a wooden pin in a mortise.

Moisture is an important factor in the strength of wood. Therefore, to a certain extent, strength increases with the degree of seasoning.

Knots or other defects also influence strength. The size, character, and location of the knots are of importance. For example, in cross-bending strength, knots on the upper surface of a beam do not detract from the strength nearly so much as knots on the lower part of the beam.

Weight of the wood is also important. Heavy woods are usually of strong structure. The strongest all-round, commonly used North American woods are longleaf pine, larch, hickory, hard maple, yellow birch, white oak, and black locust. Those of medium strength are cypress, Douglas fir, ash, beech, red oak, chestnut, and sycamore. Some of the weakest woods are white and other soft pines, hemlock, spruce, basswood, yellow poplar, cottonwood, and western fir.

**Hardness.**—Woods vary a great deal in their hardness, which may be expressed as resistance to indentation or to the saw or ax across grain. Hardness is dependent largely on weight, structure of the wood elements, and degree of seasoning. This feature is important in several methods of utilization, such as flooring, furniture, crossties, handles, and many small wooden articles.

The following table shows the relative hardness of some of the more common species in the seasoned form.

Very hard	Hard	Intermediate	Soft	Very soft
Hickory	Oak	Douglas fir	Ponderosa pine	White pine
Hard maple	Beech	Red gum	Hemlock	Sugar pine
Black locust	Birch	Tamarack	Chestnut	Spruce
Rock elm	Black gum	White elm	Yellow poplar	Redwood
Persimmon	Longleaf pine	Cottonwood	Cypress	Basswood
Osage orange	Ash		Cedar	Willow

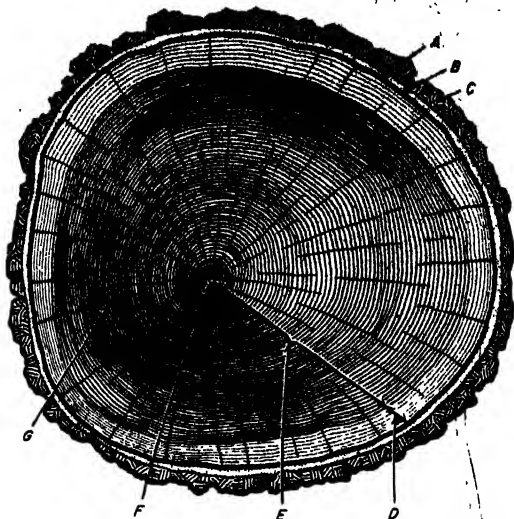
**Cleavability.**—The resistance of wood to cleavage along the grain is important when it is desirable to split timbers. The line of least resistance in cleavage is along the radius because the wood rays are in that direction. Wood splits much more easily when wet because moisture softens the fibers and reduces adhesion across the grain. Straightness in the grain, however, determines to a large degree the ease with which wood splits.

The following table shows the relative splitting qualities of some widely used woods:

Difficult to split	Intermediate	Easy to split
Elm	Birch	Chestnut
Black gum	Maple	All pines
Beech	Hickory	Redwood
Sycamore	Oak	Cedar
Dogwood	Ash	Fir
Red gum	Cottonwood	Western larch

On the whole, most North American woods are comparatively easy to split.

**Flexibility and Toughness.**—Hickory and ash are examples of flexible woods; on the other hand, hemlock and pine are brittle. Moisture content influences flexibility to a considerable degree.



U. S. Forest Service

Cross section of a tree. A, cambium layer which forms wood and bark cells; B, inner bark; C, outer bark; D, sapwood; E, heartwood; F, pith; G, wood ray, connecting the various layers from the pith to the bark.

**Toughness** refers to the combined strength, shock resistance, and pliability of a wood. Good examples of tough woods are elm and hickory, which offer high resistance to both tension and shearing.

**Durability.**—As applied to wood, durability means the ability to resist decay, or simply the length of life of a certain timber under given con-

ditions. Durability is important in connection with those usages where wood is especially susceptible to decay, such as railroad ties, poles, posts, mine timbers, and piling. Durability may also include the influence of mechanical wear, but this is relatively unimportant except in ties.

The durability of the different species is very often the determining factor in their value for several lines of utilization, especially in the case of timbers used without preservatives in contact with the soil, weather, and water.

Contrary to popular opinion, wood does not naturally decay. All decay in wood is caused by the work of fungi and bacteria which live on the starch and other materials in the wood cells and cause the wood structure to break down, leaving common dry rot, punk, bluing, and rottenness in timbers. The fungi are spread about by minute seedlike bodies, called spores, which are scattered about readily by the wind.

In order to live and propagate, fungi and bacteria must have sufficient heat (most wood decay fungi will grow rapidly only in tempera-

tures of between 60° and 90° F.), as well as moisture and oxygen. Whenever any or all of these conditions are removed, decay is not possible and, therefore, wood will last indefinitely. For example, some old piling that Caesar used in crossing certain rivers of France was found to be in sound condition when exposed 2,000 years later. Irish bog oak, submerged for centuries, remains sound because of the presence of acids in the logs and because air has been absent beneath the soil. Furniture seldom decays because moisture is absent and the wood finish prevents the entrance of fungi. For the same reason, we paint our houses and artificially inject poisonous antiseptic fluids into the wood fibers of ties, posts, and poles. A post rots at the surface of the ground first, because at that point there are the greatest changes of moisture and heat. Sapwood is more susceptible to decay than heartwood because of its greater percentage of moisture and food for fungi and bacteria.

There does not seem to be any direct relation between the physical and mechanical properties of wood and its durability. As an illustration, weight, strength, stiffness, hardness, or toughness do not seem to have any influence on the durability of woods. Some of these properties, however, aid in the prevention of injurious effects of abrasion or mechanical wear. Two of the heaviest North American woods, hickory and hard maple, are not durable, whereas some of the lightest species in weight, such as redwood, white cedar, and catalpa, are very durable. Red cedar, a soft wood, is highly durable; beech, a hard wood, is distinctly perishable.

There is, however, often a definite relation between the color of the heartwood and durability. The darker the heartwood, the more durable is the wood, especially in ebony, lignum vitae, catalpa, red cedar, black locust, osage orange, and others. Many species with light-colored heartwood, such as basswood, maple, hickory, spruce, and tupelo, are very perishable.

The durability of any species depends, therefore, on certain chemical constituents, such as resins, gums, tannin, and other decay-resisting materials. These happen to give a dark discoloration to the heartwood of several species; and this phenomenon explains the relation of color to durability.

The following table shows the relative durability of some of the more common species:

Very durable	Durable	Intermediate	Perishable	Very perishable
Black locust	White oak	White pine	White elm	Black gum
Eastern red cedar	Black ash	Norway pine	Beech	Basswood
Live oak	Cherry	Shortleaf pine	Hickory	Buckeye
Black walnut	Red elm	Red oak	Hard maple	Paper birch
Cypress	Persimmon	Red ash	Red gum	Aspen
Western red cedar	Longleaf pine	Yellow poplar	White ash	Willow
Redwood	Western larch	Butternut	Loblolly pine	Sycamore
White cedar	Eastern larch	Sugar pine	Hemlock	Lodgepole pine
Lawson cypress	Slash pine		Spruce	Balsam fir
	Ironwood		Yellow birch	Jack pine

**Color.**—Color is often a means of identification. As explained earlier, heartwood is generally much darker in color than sapwood. In some species, there is very little differentiation in color between the heartwood and sapwood. This is true especially of spruces, aspens, cottonwoods, and balsam. In some species, the borderline between sapwood and heartwood follows the line of growth rings but in maple and hickory this is not so. The color contrast between sapwood and heartwood

is very pronounced in some species, such as redwood, black walnut, black cherry, and black locust. Second-growth trees and the upper portions of the trunks of all species have a much larger portion devoted to sapwood than do virgin timber trees or butt logs. White maple furniture is derived from the sapwood of the sugar maple. Baseball bats and many forms of tool and implement handles are cut from ash sapwood. Some species, such as maple, white ash, and hickory, have wide sapwood, whereas narrow, whitish sapwood is characteristic of other species, such as black ash, black locust, western red cedar, redwood, and western larch.

All freshly sawed woods are much lighter in color than when exposed to the air or sunshine for some time. Oxidation turns all woods to darker shades. Newly sawn cherry heartwood is pinkish in appearance but the wood turns a deep dark cherry red when exposed to the light. This is also true of mahogany and other dark-colored species. Black walnut turns to a deep dark brown appearance after sawing. The heartwood of yellow poplar turns a rich yellowish green which the English call canary wood. The lustrous dark colors of mahogany, purplewood, teak, and many other tropical woods with their attractive figure and grain contribute much to their wide demand and high values.

**Luster.**—This is the quality of wood and its component parts which reflect light and give it an attractive sheen. All woods are lustrous or dull under varying light conditions. The method of sawing lumber may contribute to this quality. For example, quartersawed lumber with the cut across the wood rays appears to be more lustrous than plain-sawed boards because these rays reflect the light. This is strikingly true of quartersawed oak, beech, red gum, sycamore, and other woods with large, wide rays. Spruce and catalpa are examples of lustrous woods. Red cypress is typical of a dull-appearing wood. All woods become lustrous, to a degree, by polishing. However, some, such as mahogany, cherry, black walnut, satinwood, and teak, due to gums, resins, tannin, and oils in their heartwood and to their attractive grain, present an especially lustrous appearance.

**Odor and Taste.**—Anyone visiting a sawmill is familiar with the prevalent odors. Altogether they are very pleasant, especially when resinous species like pine and spruce or oaks with their

tannin content are being sawed. All freshly cut or sawed wood yields an odor which in some cases is distinctive and may be used as a source of identification. Sometimes odors may be traced to decay or partial decay. Cedars have a very distinctive aromatic odor which occurs in both the leaves and wood. Incense cedar of California is well named. Sassafras can be readily identified from its odor. So can camphorwood from the Far East. Some woods may be identified from their

ness as well as odor, but this property is not easily recognized or described. Many woods do not have any characteristic odor or taste.

**Weight.**—Woods vary greatly in weight from the very heavy tropical lignum vitae and quebracho to the extremely light balsa wood. All native woods of the United States and Canada have a weight, expressed in specific gravity, of less than one when bone dry (wood is said to be bone dry when it ceases to lose weight after drying in an oven at 100° C.). Thus all these woods will float when dry.

Most hardwoods are heavy, especially oak, black walnut, beech, birch, maple, ash, hickory, osage orange, and black locust. Cedars are among the very lightweight woods. Others of low specific gravity are the firs (*Abies*), hemlocks, spruces, eastern white pine, Idaho white pine, redwood, and ponderosa pine. The two most commonly used lumber species, Douglas fir and southern pine (including longleaf, shortleaf, loblolly, and slash pines) occupy intermediate positions as to weight. Weight is also, generally, a reflection of hardness and strength as well as of fuel value. Hickory is an outstanding example of a hard and heavy wood possessing excellent strength qualities. It is also rated as a top-ranking fuel wood because of its weight.

All freshly cut wood contains much excess weight in the form of water within its cells and intercellular structure; removal of the bulk of this excess weight is one of the main objectives of the drying processes (see section 3. *Seasoning*).

**Chemical Properties.**—Most of the chemical studies and research in wood have been devoted to cellulose and lignin (q.v.). Cellulose, an inert substance, is the chief component of the solid part of woody plants and is the great source of the modern paper and paper products manufacturing industry. Lignin is a substance or mixture of substances which, with cellulose, forms the essential part of woody tissue.

Wood is composed of about 88 percent cellulose and lignin in approximately equal amounts, depending upon the species. Of the balance of its constituents, the principal ones are tannin, resins, and gums. Cellulose is colorless and insoluble in ordinary liquids, such as water, alcohol, and benzene, as well as in dilute acids and alkalis. The framework of the cell walls of woods is very largely composed of cellulose.

Lignin is likewise insoluble in common solvents, but somewhat soluble in dilute alkalis. It forms the cementing agent which binds the cells together. It is mixed with cellulose in the cell walls. Lignin may be dissolved with some reagents; thus the wood cells may be separated as accomplished in chemical papermaking processes. Both cellulose and lignin contribute many special qualities to wood, such as its hygroscopicity (ability to absorb and retain moisture), its resistance to corrosion by salt water and dilute acids, and, very importantly in its commercial applications, its susceptibility to decay. The last-named feature explains why paper turns brownish so readily on exposure to the sun and the fact that it does not last very long. This is notably true of newsprint.

### 3. Seasoning

**Methods.**—The water contained in freshly cut wood constitutes from one third to more than two thirds of its weight. The removal of much of moisture is accomplished by seasoning, also known as conditioning or curing.

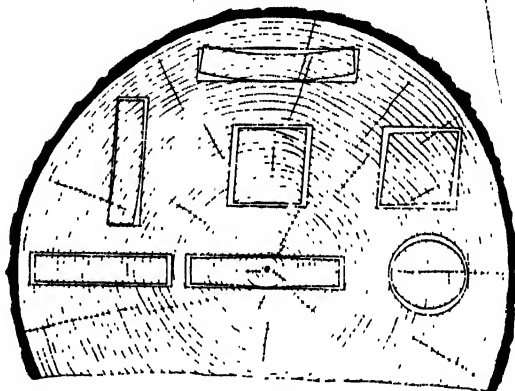
**Seasoning, or the drying of wood, is done in one of the following ways:**

(1) **Air drying, or the natural process of seasoning** by exposing properly piled wood to air. This method was formerly the only one used and is still employed to a large extent in many small sawmill operations.

(2) **Kiln drying, or the artificial method** by which the process is hastened and intensified by means of heat, humidity, and circulation of air. Use of kiln drying has sharply expanded, particularly in the United States and Canada, partly as a result of great improvements in methods.

(3) A combination of air and kiln drying. In some large mills, lumber is first air-dried until it contains from 14 to 30 percent of moisture and then finished to the desired condition in dry kilns. Some of the largest mills kiln-dry all their lumber.

Thoroughly air-seasoned lumber, dried to between 12 and 18 percent moisture content, is suitable for certain uses, such as sheathing, roof boards, subflooring, boxes and crating, and fencing; also for posts, poles, ties, tank stock, and blanks to be bent, as for hockey sticks, skis, and tennis rackets. However, hardwoods and shop



U.S. Forest Service, Forest Products Laboratory

Diagram shows how seven pieces of wood taken from various parts of a tree may be expected to shrink as they dry. Tangential shrinkage is greater than radial shrinkage.

lumber to be remanufactured into cabinetwork, furniture, flooring, handles, heel stock, and many other articles must be dried still lower by means of the dry kiln. All lumber requires at least partial seasoning for most purposes; generally, moisture reduction to not more than 120 percent of the oven-dry or bone-dry weight of the wood is required before it can be considered suitable for use. Some exceptions to this principle are piles of structures to be used under water, certain types of posts, and temporary mining timbers.

**Objects.**—The principal objects sought in air seasoning wood are as follows:

(1) The weight of lumber is reduced by 25 to 33 percent of green weight, lowering the cost of shipping. Dry lumber is handled more easily and cheaply.

(2) Since all wood shrinks with drying, it is essential, for nearly all uses, that lumber, before being remanufactured, be brought to the equilibrium moisture content of the factory in which it is to be used.

(3) Thoroughly dry wood cannot rot as no fungus can grow in it, and as long as it remains dry no rot will occur. Consequently, thorough



is a preservative usually applied to lumber at the mill; therefore quick drying in hot, moist climates is important.

(4) Seasoning greatly increases hardness, and stiffness, provided that the wood is not injured by undue checking or honeycombing. Green wood is soft and weak in comparison with dry wood.

Kiln drying, when properly done, increases the strength to the same degree as air drying. In other words, properly kiln-dried lumber is equal to the best air-dried material in every respect.

Lumber shrinks during the seasoning process and therefore it may be degraded by checks, shakes, or other defects due to this process; consequently buyers prefer to purchase lumber that has been graded and inspected after seasoning.

Timbers that are to be subjected to treatment with a preservative, such as creosote, must nearly always be at least partially seasoned; otherwise the preservative will not enter the wood properly. Timber used for bridge construction, cross-ties, poles, piling, mill construction, block paving, and similar purposes may be more economically and successfully treated if it is first thoroughly seasoned. Sometimes rapid surface drying is accomplished in hot oil during the treatment, but results are better if the timber has been previously dried.

The time required to air-dry varies with the climate, the season in which the lumber is piled, and the manner in which it is piled. The time required to kiln-dry varies with the drying system used, the use to which the lumber is to be put afterward, and the quality (grade) of lumber.

By and large, hardwoods take longer to season than softwoods. For instance, birch, beech, maple, and cherry, among hardwoods, may be air-dried from the green state to 20 percent of original moisture content in 150 to 200 days; they may be kiln-dried from the green state to 6 percent moisture in 10 to 15 days. By contrast, Douglas fir, among softwoods, may be similarly air-dried in 40 to 70 days, and kiln-dried in 4 to 8 days.

#### 4. Lumber and Related Products

Despite the great diversification of wood uses consequent on the advance of wood chemistry, lumber and related products in all their multifarious forms still comprise by far the largest wood use category, accounting for about three quarters of the volume of all wood consumed. The balance is made up, in about equal quantities, of fuelwood and pulpwood.

The following is a discussion of some of the most important related products.

**Veneer and Plywood.**—Since Roman times, thin slices of wood known as veneer have been cut from logs and used for ornamental and other purposes. In modern times, the volume of plywood manufactured has shown the greatest advance of any product in the lumber industry. In the making of plywood, 3, 5, 7, or more veneer slices are laid, one upon the other, with the grain of each at right angles to those of the sheets above and below it, and are bonded together with glue or synthetic resins. The wood chiefly used is Douglas fir, which has proved to be ideal for the manufacture of rotary cut veneer because of its large, symmetrical sizes, relatively clear wood, and comparatively low cost. Other woods used are ponderosa pine, southern pine, red gum, oak, tupelo, ash, yellow poplar, and elm. Most of the



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Wooden posts are slid into a pressure cylinder in which they are to be impregnated with preservative chemicals.

volume is in thicknesses ranging from 3-ply (totaling  $\frac{3}{8}$ -inch thickness) to 5-ply ( $\frac{3}{4}$  inch).

Plywood is used for many forms of construction, including sheathing, interior finish, sub-flooring, underroofing, paneling, flooring, concrete forms, cabinets, furniture, shelving, partitions, and ceilings. A large volume goes into containers, such as baskets, boxes, crates, trunks, chests, hampers; into boats, toys, tables, woodenware, and for repair work in attics, garages, and basements. Large volumes are used in some forms of prefabricated dwellings.

**Rotary cutting of veneer.** A thin, continuous sheet is produced by rotating the log against a stationary blade.

U.S. Forest Service, Forest Products Laboratory



The development of moisture- and heat-resistant adhesives has greatly advanced the demand for plywood, and for its counterpart, laminated wood. In the latter, the layers of wood, either veneers or boards, are laid together with the grain of all the layers running in the same direction, thereby providing a product of great longitudinal strength. Plywood and laminated wood are widely used in boats. Improved adhesives have also contributed to the use of laminated members for heavy truss construction, to the gluing together of narrow boards to make wider ones, and to the making of finger joints by which short lengths are joined to make longer pieces. This has materially assisted in expanding the use of otherwise waste materials.

**Crossties.**—In modern times, the most significant development in the field of crossties—one of the greatest of all wood consumption categories—has been the use of preservatives, thereby greatly extending their length of service. (An oak tie treated with creosote lasts 25 years, whereas the average untreated tie lasts only 5 years.) By greatly reducing the number of crossties needed, preservatives have become an important factor in the conservation of North American forests. Formerly, most crossties were hand hewed. Today the majority are sawed, the principal species used being oak, followed by southern pine, Douglas fir, and gum, in that order. With expanded traffic volumes and heavier rolling stock, the tendency has been to install larger ties, some railroads using sizes ranging from 6 by 7 inches to 7 by 9 inches in 8½- and 9-foot lengths.

**Poles, Piling, and Posts.**—Millions of relatively small, round, straight, durable trees are used annually for these important products. In the case of poles for telegraph, telephone, electric light, and power transmission lines, the most commonly used size is 35 feet long with a 7-inch-diameter top. However poles may be from 20 feet up to 100 feet long or longer. Most are treated with preservatives. Southern pine supplies more than two thirds the total number, followed by western red cedar, Douglas fir, lodgepole pine, larch, northern white cedar, ponderosa pine, and many others.

Great quantities of piling are used in all seaboard, river, and lake communities for wharves, docks, piers, holding booms, flood dams, and abutments; as well as for railroad and bridge trestlework, grade crossing eliminations, and similar purposes. In locations without rock foundations, piling is often used, as in Chicago, to support large buildings. Most strong, dense, and hard species are used, often in untreated condition if no part is exposed to changing moisture and temperature conditions. Oak, Douglas fir, southern pine, elm, hard maple, and cypress are in wide use for piling.

Posts, used by the millions on farms and ranches, by railroads, and along highways, are produced largely from farm woodlands. They are generally cut in 7-foot lengths, but some are 20 feet long. Only part are treated, although, due to improved preservation methods, the tendency is to increase preservative treatment. In the western part of the United States, redwood and western red cedar, both very durable, are the woods most widely used; northern white cedar is used in the Great Lakes states and Northeast, while cypress and treated southern pine are in wide use in the South. Where available, locust, catalpa, hackberry, white oak, mulberry, and eastern red

cedar woods are also used to make posts.

**Mine Timbers.**—Specifications of length and size of mine timbers vary widely. Many mines use round timbers from local forests. Coal mines use wood principally for props or legs and caps. The generally warm and humid temperatures render conditions favorable to decay; therefore, much timber is treated. Untreated timbers are used only in temporary shafts and tunnels. Hardwoods (oak, ash, maple, locust, and gum) comprise about 80 percent of all timbers used in the mines of the United States and Canada, the balance being supplied by softwoods, such as southern pine, Douglas fir, western larch, and ponderosa pine.

**Wood Containers.**—This is a broad category including tight and slack cooperage—the former used for liquids and the latter for a vast variety of barrels for flour, sugar, chemicals, powdered milk, and other products. It also includes boxes and crating materials from wood, used in shipping citrus fruits, canned goods, vegetables, milk, fish, apples, and many other products. Normally about 15 percent of all lumber cut is used for these purposes.

**Miscellaneous.**—Other important wood products include excelsior from soft, lightweight woods, especially basswood, cottonwood, and aspen; also hardwood dimension, which consists of small pieces of red gum, yellow poplar, oak, maple, tupelo, walnut, and other species, used principally for furniture, toys, tools, and numerous other items. Handle and implement stock are produced in important quantities from hard tough-textured woods, such as ash, hickory, and hard maple. Millions of fork, rake, hoe, spade, and shovel handles made of ash are used yearly.

In the realm of waste lumber utilization, an important and relatively new product is the compressed-fuel briquette made of wood shavings and other mill refuse. These briquettes, also known as "presto logs," are about 4 inches in diameter by 12¾ inches long, and are widely used in railroad diner kitchens, army field kitchens, automobile trailers, and ocean-going vessels.

See also LUMBER INDUSTRY.

## 5. Wood Chemistry

The field of chemicals and chemical products derived from wood has grown rapidly in importance. Some of the industries that have emerged, such as paper and pulp and their diversified products, are of major size and significance.

Wood consists of a skeleton of cellulose and, in addition, varying amounts of lignin, tannin, resins, gums, and other materials. Cellulose is readily converted into sugars. Lignin, next to cellulose, is the most abundant and widely distributed of the organic substances; it is the substance that cements together the wood cells and reinforces the cellulose within the cells. In pulp-making processes, lignin must be removed before white paper, rayon, Cellophane, or many of the other cellulose products can be successfully manufactured.

Since the first serious study of the chemistry of wood by the French chemist Anselme Payen (1795–1871), many scientists have contributed to our knowledge of this complex subject. Outstanding among them are the English chemists, Charles Frederick Cross (1855–1935) and Edward J. Bevan (d. 1921), whose fundamental work on cellulose laid the basis for the viscose rayon process, and the Swedish chemist, Johan

Peter Klason (1848-1937), known as the "father of lignin chemistry."

The growing realization of the great potentialities of wood as a chemical raw material for industry stimulated fundamental and technical research in many parts of the world, particularly in Scandinavia, Germany, Canada, and the United States. As a result, industry, academic institutions, and government agencies developed wood chemistry research laboratories, such as the United States Forest Products Laboratory at Madison, Wis.; the New York State College of Forestry at Syracuse, N.Y. (later known as the College of Forestry at Syracuse University); the Pulp and Paper Research Institute at Montreal, Canada; the Institute of Paper Chemistry, affiliated with Lawrence College, at Appleton, Wis.; and the Swedish Forest Products Laboratory at Stockholm. Contributions from workers at these and many other institutions and in industry have become evident in the many new developments in processes for making rayon, films, lacquers, plastics, pulp, paper, fiberboards, and other chemically produced forest products.

World War II stimulated developments in wood chemistry as in other fields of science and technology. In Europe these were mainly in the direction of foodstuffs and industrial chemicals, such as sugars, alcohol, cattle fodder, yeast, tall oil products, butanol, glycol, and other organic chemicals. Developments along these lines also took place in the United States, such as the United States Forest Products Laboratory method of wood hydrolysis. In addition, new important structural and plastic products have emerged. These include the newer paper-base laminates, lignin-paper laminates, dimensionally stable chemically modified wood, and the combination of synthetic resins with paper, veneer, and wood to make many types of light, strong, structural forms for aircraft, boats, and buildings.

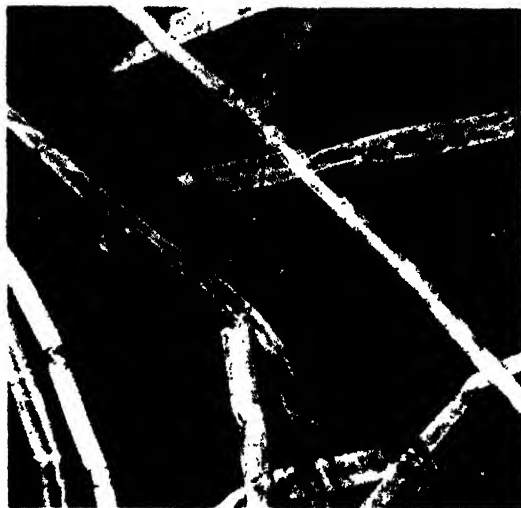
The growing realization in the lumber and other forest industries of the need for a better-integrated utilization of their raw wood material has led to greater utilization of wood waste. In the United States, this has been particularly apparent on the West coast in both the Douglas fir-hemlock areas and in the redwood region. This, with its promise of better forest management and timber use, has been one of the most significant trends in wood chemistry.

## 6. Wood Chemistry Products

**Wood Pulp and Products.**—Wood is the source of the bulk of the world's paper. In the United States, about 90 percent of all paper is made wholly or largely of wood. Although there are hundreds of pulp and paper mills scattered throughout the country, the principal states of production are New York, Maine, Wisconsin, and Washington. Canada, source of four fifths of all newsprint used in the United States, also has a vast pulp and paper industry, concentrated chiefly in Quebec, Ontario, and British Columbia. Spruce has been the traditional wood used because of its long, strong fibers and its availability. But southern pine has advanced rapidly and now supplies more than half of all the wood used for papermaking in the United States. Other principal woods used are hemlock, aspen, chestnut, yellow poplar, and gum. Many mills are now using sawmill waste, such as slabs, edgings, trimmings, and chips.

The principal chemical methods of making

paper out of wood pulp are known as the sulphate, soda, and sulphite processes, of which the first two are alkaline processes and the last-named an acid process. In all three cases, wood chips are "cooked" in chemical liquors to produce the pulp that goes into the papermaking machines. In addition to these methods, wood is converted into pulp for making paper and other products by mechanical means. See also **CHEMICAL INDUSTRIES—Pulp and Paper; PAPER.**



State University of New York, College of Forestry

Hemlock wood fibers, greatly magnified. They are chemically bleached for use in white paper.

**Rayon.**—Rayon, or artificial silk, has expanded enormously since the first mill produced it in France in 1899. In 1892, with the development of the viscose process, the foundation was laid for the gigantic rayon industry of modern times. The raw material for making rayon by the viscose process is cellulose obtained from western hemlock, spruce, and southern pine, as well as cotton linters. It is the source of approximately nine tenths of all rayon produced. Wood pulp is also a major source of rayon made by the cellulose acetate process. See also **TEXTILES, SYNTHETIC—Rayon.**

**Plastics.**—As applied to wood products, plastics include cellulose derivative plastics, lignin plastics, pulp-molded products, and wood particles welded by a synthetic resin matrix. The first named is the most important. Sawdust, wood flour, lignin from waste pulping liquors, and other sawmill wood wastes have received wide attention as bases for making plastics. See also **PLASTICS.**

**Naval Stores.**—These comprise rosin and turpentine obtained from the resinous gum of longleaf and slash pines. In the United States, the industry, dating back to colonial times, is now centered in southern Georgia and northern Florida. Trees are tapped weekly during the growing season for a resinous exudation or gum which flows into tin cups. This is distilled for turpentine, the residue being screened for rosin. Both products have an important place in industry. See also **CHEMICAL INDUSTRIES—Turpentine and Rosin; NAVAL STORES.**

**Hardwood Distillates.**—These are derived through the heating of wood for carbonization to

make charcoal and for the recovery of vapors to make wood alcohol and acetate of lime. The woods chiefly used have been hardwoods such as beech, birch, oak, and maple. Through chemistry, however, synthetic products have replaced wood alcohol and acetate of lime, while the use of charcoal has decreased; therefore many plants have gone out of existence. See also **CHEMICAL INDUSTRIES**.

**Softwood Distillates.**—These products are an outgrowth of hardwood distillation and, in the United States, the industry is found only in the South. The most successful method used is the chipping of old pine stumps and their distillation to recover rosin, turpentine, and pine oil.

**Extractives.**—Wood, as well as bark and leaves of many species, both foreign and domestic, serves as the source of many tannins, dyes, medicinal preparations, volatile oils, and similar products. Indians were found using oak bark to preserve buffalo hides. Hemlock bark tanneries were important in the early development of the United States. The tannin was extracted from chestnut wood. Quebracho is now the chief source of tannin.

Formerly many dyes were produced from various tropical woods as well as from the osage orange, while quercitron was obtained from black oak and other species. Fustic and logwood are important foreign sources. Aniline dyes have replaced many of the wood dyes.

Among the extractives are storax from sweet gum; volatile oils from sassafras, sweet birch, and red cedar; Canada balsam from fir; mucic acid from western larch; and cascara from the cascara tree of Oregon. See also **DYES AND DYEING**; **TANNINS**.

**Densified Wood.**—At first, this product was known as improved wood; later it became more commonly known as densified or modified wood. The process of making densified wood consists of filling or closing the voids in the cellular wood structure, accompanied by compression under heat. This process adds hardness, increased strength, greater durability, and dimensional stability. In some forms, however, the process reduces toughness, and in all cases it makes the wood much heavier. Compression of wood fibers is generally accompanied by impregnation with phenolic resins and urea resins. By some methods, compression of wood is done without impregnation. Impregnation with phenolic resins is usually done in veneer sheets,  $\frac{1}{8}$  inch thick and laid one upon the other with parallel grain direction before pressing. Impregnating thick, solid wood is a very slow process. Variable density may be secured by tapering down the length of alternate layers and pressing to a uniform thickness. In other cases, impregnated veneer layers may be placed outside an assembly when surface hardness and light weight are required; or they may be placed where a readily glueable surface is essential. Commercial products of the resin-impregnated type are variously known as Compreg, Pregwood, Pluswood, and, when pressures do not exceed 200 to 500 pounds per square inch, the product is known as Impreg. In England it is known as Jicwood. Due to their strength and hardness, some densified woods have replaced metals as material for gears and die castings, and for many other items. When various types of paper layers are used instead of layers of wood veneers, the final product is known under technical and trade names, such as Papreg, Consoweld,

Formica, Micarta, and Panelyte. Some densified wood products have found useful outlets in several branches of the furniture industry. Although an entire piece of furniture may not be made from densified wood, certain parts, such as table tops, legs, and exposed portions subject to severe usage and wear, are made from them. A market has been developed for shuttles, golfheads, flooring, and highly specialized uses where a heavy, dense, hard, and durable surface is required.

See also **FORESTRY** and articles about specific classes and species of trees.

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**WOOD ALCOHOL** or **METHYL ALCOHOL** or **METHANOL** (also called **CARBINOL**), an important industrial chemical belonging to the class of organic compounds called alcohols and having the formula  $\text{CH}_3\text{OH}$ . It is a colorless liquid boiling at  $64.5\text{--}64.7^\circ\text{C}$ . and freezing at  $-97.5^\circ\text{C}$ ., miscible with water and most organic liquids, flammable, and highly poisonous when taken internally.

The name wood alcohol derives from the method formerly used to make this substance, described by Robert Boyle in his *Sceptical Chymist* in 1661. The method involves the destructive distillation of hardwoods, heated in the absence of air to above  $250^\circ\text{C}$ . Charcoal and a gas which condenses to pyroligneous acid are produced. This acid separates into a dark-colored, heavy oil and a lighter aqueous layer from which wood alcohol, acetic acid, acetone, and other chemicals are obtained. Since the 1930's wood alcohol has been made by the reduction of carbon monoxide or dioxide with hydrogen in the presence of a metallic-oxide catalyst, at  $350^\circ$  to  $400^\circ\text{C}$ . and at pressures of 3,000 pounds per square inch or over. It is also made by partial oxidation of hydrocarbons from natural gas.

Wood alcohol is the raw material for the manufacture of formaldehyde and an intermediate in the synthesis of other industrial organic chemicals. It is used in antifreeze mixtures; as a component in special fuels; as a general solvent in making such products as paint removers, surface coatings, dyes, and adhesives; and as a denaturant for ethyl or grain alcohol, since it cannot be made nonpoisonous.

See also **ALCOHOL**; **TOXICOLOGY—Organic Poisons**.

**WOOD ANEMONE**, the name of *Anemone nemorosa* of Europe and eastern Asia, and of the closely related *A. quinquefolia* of North America, also called the windflower. *A. nemorosa* has a horizontal rhizome; the aerial stem is 3 to 9 inches tall, and terminates in a single flower opening in early spring. The basal leaves, which appear later, are 3- to 5-parted, and toothed;

the 3 leaves subtending the flower are similar, but somewhat smaller. The flower, an inch or more across, is white to purplish, with 6 to 9 perianth parts, numerous stamens, and 10 to 20 pistils. *A. nemorosa* is cultivated, and some forms occur with larger flowers, double flowers, and rose to purple perianths. *A. quinquefolia* differs in its more delicate habit, slenderer rhizomes and leaf stalks, and slightly smaller flowers. It is an attractive woodland plant of early spring, widely distributed in North America. It also exists in several forms, and has sometimes been considered a variety of *A. nemorosa*. The European and Asiatic forms of *A. nemorosa*, and those of the American *A. quinquefolia*, illustrate the diversity achieved by a presumably single ancestral species which has become widely distributed over periods of time.

EDWIN B. MATZKE.

**WOOD-BLOCK PRINT.** See BLOCK PRINTING; WOOD ENGRAVING AND WOODCUT.

**WOOD BUFFALO NATIONAL PARK,** Canada, a large unfenced wildlife sanctuary and wilderness area located in northeastern Alberta and southern District of Mackenzie, Northwest Territories. Its 17,300 square miles contain forests, plains, and many streams and lakes, including Lake Claire, which is 40 miles long and 28 miles wide. It is crossed by the Peace River, and its eastern boundary consists of the Athabasca River to the south and, in part, of the Slave River to the north, all of these streams being famous in the history of Canada's early exploration and the fur trade. Administered by the Canadian Department of Northern Affairs and National Resources, the park was established in 1922 to protect the only remaining herd of wood bison, *Bison bison athabasca*. Some plains bison (*B. bison bison*) were added from 1925 to 1928. The herd was estimated to number as many as 15,000 individuals in 1962. The park also contains the only known nesting grounds of the nearly extinct whooping crane. See also BISON—American; CRANE.

**WOOD CARVING** (also written WOODCARVING), the process and product of shaping wood into decorative and sculptural forms. The latter is also called *wood sculpture*.

Many qualities of the dried trunks of trees have recommended them for various uses since the early beginnings of the crafts. Wood is a widely prevalent and self-restoring source of supply, available in sizes suitable for small objects as well as buildings. Strong enough to support great weight and to span considerable areas, it is not too heavy to be handled by an economical amount of manpower nor too resistant to be worked readily and accurately with simple hand tools. Wood has a pleasing range of natural color, tonal depth (due to the annular structure or grain), and receptivity to a number of sensuously satisfactory surfacing treatments. See also WOOD.

Three general conditions have contributed to the growth of wood carving in different historical periods:

(1) In primitive and ancient societies wood was often used because of its prime availability and ease of working.

(2) In rich and highly developed societies wood carving has remained an important decorative

medium, extensively used in building.

(3) Predominantly aesthetic and individualistic interests of modern art in the West have brought about a small revival of wood sculpture because of its unique qualities as material and the directness of the carving process.

Although these categories are not mutually exclusive, they afford a useful basis for dividing the subject.

**Primitive and Ancient Cultures.**—Because vast forests of large trees occur on the moist, temperate Pacific coast of North America, the economy of the American Indians residing in that area was based extensively on wood. The anthropologist Franz Boas has described a tribe which used wood even for the sails of its boats, regulating the strokes of the adze by which the sails were shaped so that the surface acquired a simple but distinctive rhythmic pattern. The socially and religiously important totem poles prevalent throughout this area are well known, and wood carvings of similar import were used to decorate family and tribal buildings.

African Negro culture and that of the Pacific islands have produced an art of wood carving which embodies great expressive and decorative ingenuity, and which has become an important influence on sophisticated western European expression as well as a prized field for collectors. Much of the work has a fetishistic religious function, especially in connection with ancestral and funerary rites. Decorative carving is applied to furniture and buildings, and in the South Seas also to boats. Both cultures use wood extensively for the carving of ceremonial masks. An important aspect of this work is the profound ingenuity of the artists in applying traditional modifications to human and animal shapes, reducing parts to their simplest geometrical denominator and arbitrarily modifying natural proportions. See also MASK.

Wood was used for many important works during the early dynasties in Egypt. Figures of servants and others intended to provide sustenance and activity for the deceased ruler in the life after death were often made of wood in the Old Kingdom (2664–2155 B.C.), as were ceremonial figures of the ruler himself. Wood was even used for the portrait statue enclosed in every Egyptian tomb as a resting place for the soul (ka). See also EGYPTIAN ARTS.

The absence of wood in ancient remains, especially in moist climates, may often be due to its perishability. This is doubtless true of remains from the Eurasian nomads, especially in northern regions, and in the case of early Greek sculpture. There is ample evidence that the Greek temple evolved from a wood and brick structure, and early records refer to highly venerated statues called xoana which seem to have been merely logs with a rough indication of a head at one end and with actual textiles for clothing. These very possibly may have evolved into some form of wood carving, for the earliest archaic Greek figures have a quality that suggests the structural refinements of wood, as in early Egyptian wood figures; but if such works existed they have now entirely disappeared.

**Architectural Decoration.**—By far the most elaborate and prolific production of wood carving has occurred in societies which developed wealth and skill, yet for some reason did not supplant wood entirely with metal and stone (generally considered more monumental and



elegant materials). This would be either because wood was so prevalent that it had an overpowering economic advantage, as in medieval western Europe when much of the land had not yet been cleared of primeval forests, or because its ready workability was still important during early stages of technical development, as in North Africa and the Far East. Before the age of mechanical woodworking tools like the circular saw and the planer, it was virtually as laborious to smooth the surface of a beam or panel as it



The Metropolitan Museum of Art

A 16th century Flemish Deposition group, carved in oak in high relief, possibly at Antwerp.

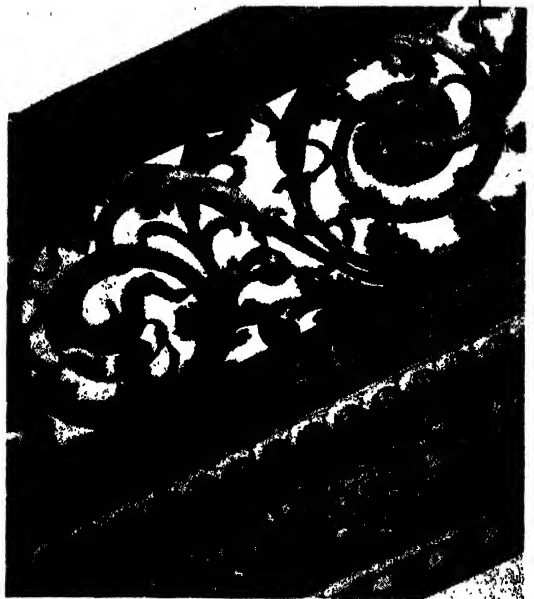
**Medieval Europe.**—Although monumental architecture throughout Europe (except in the Baltic region) has always been predominantly of stone or brick, much of the decoration was accomplished by wood carving. Wood used for church furnishings in the Middle Ages, such as choir stalls, lecterns, rails, rood screens, and the like, was elaborated with surface carving to match the rich sculpture and decoration in stone on the outside of the building. Finely shaped wood was used also for ceilings and other interior features, such as wall paneling, in the more elegant domestic architecture of the period.

Wood carving was carried to its highest development in Europe by the High Gothic art of southern Germany early in the 16th century. Great skill was concentrated in the elaborate retables and in altarpieces consisting of a large central scene of figures, carved in full round, and wings depicting related subjects. These wings were carved in relief, front and back, and were hinged at the sides of the central panel so that the sculptural decoration would be visible when closed as well as open. One of the greatest of these was the altarpiece (*Assumption of the Virgin*) in the small church of Creglingen, Fran-

conia, Germany, by the outstanding wood-carver of all Western tradition, Tilman Riemenschneider (q.v., 1460?-1531).

Innumerable small religious carvings in wood, often polychromed, also were made for domestic use at this time, and carving of various degrees of elaboration was applied to the walls and furnishings of civic and domestic buildings. A peculiar motive derived from an important article of trade was the linen fold, used for flat areas on furniture or on the repeated sections of wall paneling.

Italian Renaissance forms of cultural expression, adopted generally by the aristocracy of Europe in the period when modern nations were forming, replaced wood with marble and bronze as the important sculptural mediums, and painting became widely used on the walls. As the distinction between "artist" and "craftsman" grew with the constant demand for stylistic invention in major works of art, wood sculpture almost ceased to be produced, and decorative



The Metropolitan Museum of Art

Detail of woodwork in a 17th century English staircase.

carving was reduced to a minor mechanical craft that can best be studied in terms of the historical styles of interior decoration such as Jacobean, Georgian, Chippendale, Biedermeier, and so on (see FURNITURE).

There were two notable survivals of the tradition, however. England produced an important wood-carver after the adoption of Renaissance style. Grinling Gibbons (q.v., 1648-1720) decorated the interiors of many of the churches designed by Sir Christopher Wren, as well as important aristocratic mansions. Although technically his work could not have been produced without the antecedent Gothic development of the craft, his style is that of the Renaissance in its classically detailed architectural columns and entablatures, and in the highly naturalistic garlands of fruit and foliage in full relief, reminiscent of the terra-cotta frames made by the della



The Metropolitan Museum of Art

Above: Egyptian painted wooden models representing a funerary group of offering bearers, from the 11th dynasty tomb of Meket-Re at Thebes, dating from about 2000 B.C.



The Museum of Primitive Art

Above: Wooden mask, carved by an African, probably in the 19th century. It was found in Nigeria.



Right: An evocative medieval wood carving, *Mater Dolorosa*, by an unknown 13th century Spanish artist.

The Hispanic Society of America



Left: Late 15th century Flemish shrine of painted and gilded wood, depicting the family of St. Anne.

The Metropolitan Museum of Art

Right: St. Stephen, a linden wood figure by the German sculptor Tilman Riemenschneider (d. 1531).

The Cleveland Museum of Art

Below left: Carved eagle, from the Shenandoah Valley of the United States. Below: Ship's figurehead (c. 1850) by Isaac Fowle of Boston.

National Gallery of Art



Robbia family in the 15th century Florence.

A less monumental but longer-lived survival is seen in the folk art of the villages, principally in central Europe, where the craft of carving chests, clock cases, and other furniture, as well as small religious and genre figures, has been handed on with little change from generation to generation. A special type of design known as chip carving appears widely in this type of work. The "chip" is a small isosceles triangle, deepest at the apex, that is dug out of the wood with the point of a knife. An elaborate geometrical pattern is built up by removal of innumerable adjacent chips.

**North Africa and the Far East.**—The subsection of a numerous working population through the caste systems of the great Asiatic cultures encouraged the development of subtle and exacting procedures in the crafts and made available vast quantities of labor for the elaboration of the product. Wood was used extensively in building, sculpture, and household furnishings (although other mediums were likewise prevalent), and the characteristic design was a rich over-all coverage of the surface with fine though often repetitious detail.

Wood was used for religious and theatrical masks in Japan, and ancient examples made for the no (Japanese *nō*) drama have been handed down to the present in the families of the actors (see *DRAMA—Japanese Drama*). Japanese domestic interiors are quite simple in general, but a

carved ventilating panel called a *ramma* is a characteristic feature. Special locations like the family shrine (*butsu-dan*) and a niche for highly prized objects of art (*tokonoma*) are also decorated with fine carving. Chinese interiors tend to employ much more carving, including rich elaboration of ceiling beams and columns. Religious shrines in both countries have been extensively decorated with wood carving in various periods, and in Japan quite monumental buildings have been constructed entirely of wood.

Similarly rich and extensive uses of carved decoration in wood are characteristic of Mohammedan art in North Africa. The Muslim prohibition against representation of human and animal figures stimulated the development of elaborate geometrical patterns, often with simple repetitious phrases in Kufic lettering (see *KUFIC* or *CUFIC WRITING*), worked as a border or focus of the design.

**Modern Revival.**—Demands for constant novelty in 20th century art of the Western world have caused a number of sculptors to explore new or unused technical means. The use of wood has been revived for its ingratiating sensuous qualities of color, finish, and texture. Its workability also serves the competitive, individualistic situation of the modern sculptor, enabling him to move directly toward the final result with no intermediate processes like the casting of metals or the firing of clay. Thus he is relieved of costly investment of labor or funds (beyond the capacity of many individuals in an uncertain market), and he has the progress of his conception under direct control and in constant prospect.

Northern countries, perhaps because of their strong Gothic heritage, seem to have produced the most notable wood-carvers. Carl Milles (1875–1955), a Swedish sculptor who executed many commissions in the United States and who was director of the Cranbrook Academy of Art in Bloomfield Hills, Mich., used wood for the large, somewhat stylized mural (*Man and Nature*) in the lobby of the General Dynamics Building, Rockefeller Center, New York. The German sculptor Ernst Barlach (1870–1938) practiced wood carving to a greater extent than any other well-known modern artist. His genre figures, carved in broadly simplified but naturalistic masses, suggest the genre phase of Gothic tradition.

England's most noted contemporary, Henry Moore (1898– ), has occasionally used wood. Constantin Brancusi (1876–1957), the Rumanian sculptor who worked in Paris, has been the chief exploiter of the sensuous qualities of wood in abstract aesthetic forms which follow the cubist development in painting.

**The American Tradition.**—Wood played a great part in the early economy of the North American colonies, a fact reflected by the growth of wood carving according to all the aforementioned motivations for its use. Pioneering farmers carved weather vanes and other figures in untutored primitive style, probably for recreation in periods of inactivity such as snowbound winters. Utensils like cake and butter molds were carved with decorative patterns in wood. Eighteenth century prosperity brought extensive building, largely in wood decorated by Georgian classical motifs. A noted carver of this type of decoration was Samuel McIntire (q.v., 1757–1811), who built and decorated a number of elegant houses in Salem, Mass., and also carved

The contemporary American sculptor, Chaim Gross, at work on his *Ballerina* in 1940. The 31-inch figure was carved out of a solid block of hard imbuia wood.



furniture and did portrait sculpture in wood.

A considerable industry was involved during much of the 18th and 19th centuries in carving decorations for wooden ships, chiefly figureheads (see **FIGUREHEAD**) and decorative stern pieces. William Rush (1756-1833) of Philadelphia, who was the first native-born professional sculptor in the United States, carved in wood and made a number of figureheads. Many pictorial shop signs were carved in wood, a type of which, the cigar store Indian, remained in use until the early decades of the 20th century. During the period of western expansion, carving as a pastime developed a tradition in the Midwest of whittling, in which Carl Schimmel became noted for his small genre groups. A much earlier tradition was that of the primitive religious carvings (known as *bultos*) of the Spanish Southwest.

In the 20th century several artists resorted to wood for the aesthetic subtleties of the material as well as for the directness of the carving process. Chaim Gross (1904- ) used wood almost exclusively, and many others, like José de Creeft (1884- ) and Isamu Noguchi (1904- ), included it in a range of materials for occasional use. Very few of the conservative sculptors have used wood; but a number of gracefully refined figures on a small scale were produced by Allan Clark (1896-1950).

**Technique.**—Wood can be accurately shaped into complex forms by an amount of effort well within the capacity of the human hand using an edged steel tool. The end of a small, flat bar is ground to an angle of about 60° and then honed on a hard, fine-grained stone to a degree of sharpness that is microscopic. Shavings of wood may be removed by pushing the edge of this tool, called a chisel, against the block, at the same time sliding it laterally. Larger quantities of wood may be removed by driving the opposite (handle) end of the chisel with a mallet. Less efficient techniques were used by wood-carvers before the discovery of steel.

The edge of the tool may be curved in various arcs, in which case it is called a gouge. The edge may make a 60° or 90° angle to the tool's length. Very narrow-angled or curved tools are called veiners. Since the heavier cutting is first done by the gouge, and the chisel is then used largely to reduce the furrows to a smooth plane, carvers sometimes call the straight chisel a firmer, and it may be ground somewhat differently from the carpenter's chisel. The shanks of gouges and chisels may be given a variety of splayed ("fish-tail") and bent shapes for access to interior planes or to shape small planes efficiently in one stroke, and the width of the edge may vary from 1/8th of an inch up to 2 inches. An assortment of sizes in all available shank shapes could expand a wood-carver's collection of tools to a very high number, but a serviceable range can be made up of one or two dozen items.

Files and rasps in a range of shapes and degrees of fineness are used for smoothing the surface of the wood preparatory to the final sanding, although some artists prefer the more animated quality of the tooled surface. Some finishers recommend burnishing the surface with a harder piece of wood or with the standard burnishing tools (steel, agate, and so on) used throughout the crafts. A final finish may be applied in any of the well-known transparent substances such as shellac, varnish, oil, and wax—with or without preliminary use of a stain—or the work may be

painted with opaque substances, concealing the grain and applying a color scheme that is naturalistic or otherwise independent of the limited natural color range of wood. When this type of polychrome surface is to be used, fine sanding and other final-stage polishing techniques are generally omitted, and a prime coat with some body like gesso (fine plaster) is applied in order to achieve smoothness.

The fibrovascular structure of wood brings about certain conditions that must be taken into account by the carver. The cutting tool moves most readily in a direction generally paralleling that of the fibers ("with the grain"), but care must be taken not to split the wood. This precaution is less necessary with denser, close-grained woods, more necessary with lighter, open-grained woods. Projections should be made in a direction coinciding as closely as possible with the grain of the wood, as "short grain" is weak. That is to say, a piece of wood with the grain running at right angles to its length is apt to split off under pressure. For this reason it is necessary to design figures in wood somewhat massively, without too much articulation. The problem also may be overcome by carving different parts of the figure as an arm, a leg, and so on from different pieces of wood, with the grain in the right direction for each. Skilled techniques are required for assembling such figures; otherwise a generous amount of gesso must be used to conceal the joinings.

Trees grow only to a certain size, and a block may not be the full diameter of the trunk since it is inadvisable to use heartwood (the center of the log). This is because of excessive checking or cracking in that area from the tensions set up by shrinkage as the wood dries. Therefore, the scale of wood sculpture is limited; but there are ways of extending it somewhat. Planks can be "glued up" into sizable blocks. Joining may be employed as described. Large compositions may be made by assembling a number of individually carved figures against a constructed background. In rare instances very large figures have been constructed on a wood framework with a planked surface.

Unlike metal and ceramic products, facsimiles of which may be produced by various casting techniques, a carving is unique. However, there are machines which can reproduce rapidly and simultaneously from a master pattern a number of simple pieces such as furniture details (the foot of a bureau or the arm of a chair), small objects such as smoking pipes, and even uncomplicated sculptural figures. These work either on the principle of the router (for flat panels or relief carving) or on that of the lathe (for three-dimensional pieces), with a series of tools cutting into a series of blanks until a controlling finger comes in contact with the surface of the master pattern. Elaborate shapes and undercutting cannot be accomplished in this manner, but the pieces produced by the "gang carver" generally are finished with varying amounts of hand tooling. The amount of hand tooling performed on such an individual piece is proportionate to the prospective price of the object.

For a discussion of wood carving in Canada, see **CANADA—31. Art and Architecture** (Decorative Arts and Crafts).

LINCOLN ROTHSCHILD, *Author of*  
"Sculpture Through the Ages"  
and "Style in Art"

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**WOOD CHARCOAL.** See CHARCOAL.

**WOOD DUCK**, a small American duck (*Aix sponsa*), the most beautiful of the ducks of North America. It inhabits quiet bodies of fresh water in wooded regions, especially swamps and secluded ponds, breeding from southern Canada west to Manitoba and south to Cuba and Texas, and from British Columbia to California. It is migratory, wintering from the southern United States to central Mexico and Jamaica.



Karl H. Maslowski from National Audubon Society  
 Wood duck (*Aix sponsa*).

No words or picture can adequately express the beauty of the male wood duck, with its iridescent greens, purples, and blues, set off by bold patches, spots, and streaks of white and black. Its flanks are delicately streaked with brown and black, and it has a big flowing crest. The woodland setting enhances its beauty still further. The female is iridescent on the wing and has a short crest, but she is more sedate in coloration, chiefly grayish and brown. No other waterfowl is so handsome with the exception of the related mandarin duck (q.v.), *A. galericulata*, of Asia. The nest is placed in a hollow stump or a cavity of some standing tree, often at some distance from water; and when they are ready to leave the nest the young jump to the ground. The wood duck should be rigidly protected by law, but unfortunately it is still hunted. See also DUCK—Perching Ducks.

CHARLES VAURIE.

**WOOD ENGRAVING AND WOODCUT**, a print made from a block of wood by cutting away areas of the surface so as to leave lines that receive ink for transfer to the paper. Originally the woodcut was strictly a means of reproducing a line drawing, and at a very early stage the cutting was handed over to a specially trained group of crafts-

men, the artist being responsible only for the drawing itself. Specializing in this way, the wood-block cutters soon became highly skilled and capable of reproducing complex pen drawings, as can be seen in the work of Albrecht Dürer (1471–1528) and contemporary German artists.

As the painting mediums became more concerned with optic effects of light and shade, graphic mediums such as etching and engraving were invented to make similar tonal effects possible in prints. Wood engraving was developed for the same purpose. However, whereas the later graphic mediums are printed with ink deposited in lines cut into metal plates (intaglio), wood engraving prints ink deposited on lines or masses remaining at the original surface of the block (relief), exactly as woodcuts do. The difference is that in the earlier form (woodcut) the artist thinks only of the black lines of the drawing, cutting away the blank white areas, whereas in the engraving process the artist first blocks out a light and dark pattern, and in the dark areas simply reduces the darkness of the solid black tone by cutting relatively fine lines into it. Wood engraving is thus sometimes called the "white-line" method, as the artist no longer thinks exclusively in terms of the black lines in the drawing but also of the white lines that form the design and gray the dark masses.

An intermediate stage was the so-called chiaroscuro print, in which a light tint was printed under (before) the black-line woodcut, with a few highlights scooped out here and there, so that the final effect was that of introducing a halftone between the white of the paper and the black of the printed line (as in pen and wash drawing). Although this method involved cutting and printing an extra block, it simplified the cutting of the drawing immeasurably, as the tones built up with laboriously cut parallel and cross-hatched lines could be omitted. Wood engraving brought the lines and tones together again on one block and elaborated the development of the halftone.

**Tools and Techniques.—Woodcut.**—In the woodcut the design is generally cut on a plank of the desired size so that the grain runs with the surface. Any smooth-grained wood, such as cherry, American whitewood, maple, beech, sycamore, pear, or apple, may be used. The primary tool is a knife, supplemented by gouges for removing large areas. When cutting, the knife is inserted into the block on a slight slant so that the line or section to be eliminated will be smaller at the bottom, and in order that the wood which remains standing will have a wider base. The knife is drawn toward the body as it makes the cut. Another cut is made at an opposite angle to remove the wood between the lines, forming a trench. The artist may proceed as far as he wishes before taking a trial proof, or, if desired, he can cut out all the large areas with a gouge and then proceed with the finishing touches. Finally, the block is cleaned with a rag moistened with benzine or other cleaning fluid; then a dampened cloth is used to remove all traces of india ink or other drawing; and, when dry, it is carefully gone over with a soft brush.

The woodcut is now ready for printing. Printer's ink is rolled out evenly on a smooth stone or glass plate, and a hard roller charged with ink is run over the block. The ink remains on the surface of the raised lines, leaving the sections that have been cut away free from ink. For a trial





Above: *St. Christopher and the Christ Child*, 16th century chiaroscuro print from woodcut by Lucas Cranach the Elder.



Above: A powerful, mask-like *Self Portrait* by one of the great modern woodcut artists, Käthe Kollwitz (1867-1943).

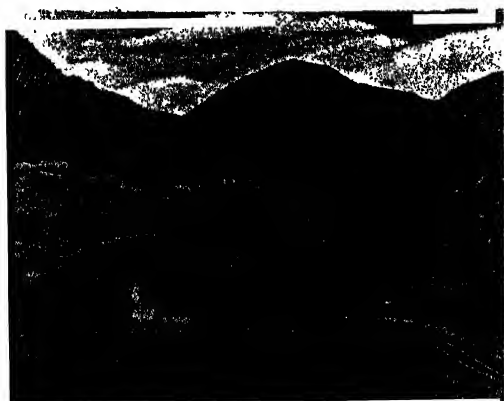
Below: *Alles de Pigeon* by Georges Rouault, wood-engraved illustration in the manner of the master's oil paintings.



## WOOD ENGRAVING AND WOODCUT

Wiggin Collection, Boston Public Library

Below: *Rural Schoolhouse, Vermont*, a wood engraving of almost photographic clarity and detail by Asa Cheffetz.



proof the paper is placed on the inked block and pressure is applied with a vertical press. When no press is available, the back of the print may be rubbed with a bone paper folder, the back of a spoon, or a burnisher, taking care that the paper is not torn by applying too much pressure, particularly along the sharp edges of the lines. If the block is small or thin, a smooth card can be placed over the printing paper to afford greater protection. When the rubbing is finished, the print (which is in reverse) can be carefully lifted from the block.

**Wood Engraving.**—Boxwood is used for wood engraving because of its hardness and fine grain. The block is cut across the growth of the tree, so that the composition can be engraved on the end of the grain. The trunk of the boxwood tree being limited in diameter, a number of sections are assembled to make the required size block, which is then cut to 0.9186 of an inch (standard type height). In modern printing, however, electrotypes are used for printing rather than the wood block itself. The block is then evened off, rubbed down, and polished until it has a perfect and flawless surface.

In wood engraving the drawing is transferred to the block in various ways. Apart from the more recent commercial method, the one most commonly used during the period of reproductive engraving was to cover the surface with a thin coating of Chinese white and then to draw or trace the design carefully with pencil. The tracing was carried far enough to indicate relative values as a guide to the engraver. Another method, more frequently used today, is to paint the block black with india ink and to transfer the design with red carbon paper. The artist then engraves directly through the ground, exposing the lines with the graver; these appear white against the darkened surface. The exact manner chosen is determined by the amount of preparatory work the artist desires on the block before engraving.

The tool used for engraving is the burin graver, of which there are many types and sizes, including the scorper, lozenge-shaped graver, spitz-sticker, tint tool, V or parting tool, gouge, chisel, and burnisher. These are mounted in rounded handles, cut away on the underside to avoid interference with the block when held low. The curved top of the handle fits into the palm of the hand; the thumb extends along the side of the blade, and the fingers are curved in such a manner as to press the tool against the ball of the thumb. In contrast to woodcutting (in which the knife is drawn toward the body), the graver is pushed away from the body, with just enough pressure to allow the burin to penetrate the wood. The block itself rests on a round leather sandbag, and the left hand moves the block from left to right so that the curved or parallel lines are engraved with ease. The artist may see his engraved work by rubbing a small amount of whiting (calcium carbonate) into the line. It is essential that all engraving tools be kept well sharpened; the perfect sharpening of the various kinds of tools is a precise art in itself.

Before printing, the block is cleaned with a soft brush. It is then inked and the trial proofs are taken in the same manner as the woodcut. Corrections of errors are difficult in wood engraving. An engraved block can be repaired by drilling a hole over the mistake and inserting a round, tapered piece of boxwood. The part of the peg

which protrudes above the block is then cut off as near the surface as possible, sanded over, and polished ready for the corrections. Lines may be reduced by rubbing them down with fine emery paper to obtain the necessary value of the line or mass.

**History.—Early Works.**—The actual date of the origin of printing from wood blocks is in doubt. In India wooden stamps have been in use for printing on fabrics from an early age, and in the 10th century the Chinese had books printed from tablets of wood. The illuminators of the Middle Ages in Europe used stamps as key blocks to produce initials on manuscripts, which they later colored by hand. The earliest known woodcuts, depicting scenes from the Scriptures and the lives of the saints, date from the early part of the 15th century. Prints taken from rudely cut blocks appeared in the books of the 15th and 16th centuries. Most of these prints, which originated in Germany and the Netherlands, were produced by hand rubbing. Often a pale brown ink was used, and sometimes was added with a brush. These so-called "block books" are noteworthy for their beautiful composition and design. The illustration and the text, usually in Latin, were cut on the same block—a practice which flourished up to the invention of movable type. Among the earliest and most important examples of the block books are the *Apocalypsis Sancti Johannis* (Visions of St. John), *Ars Moriendi* (The Art of Dying), and *Canticum Canticorum* (Canticle of Canticles). These works were published in many editions and enjoyed a wide circulation. See also *Block Book*.

With the invention of printing by means of movable type in the mid-15th century, the woodcut was given a new stimulus. As books became more and more common, an increasing number of illustrations appeared. The Bible was the book on which the early printers spent most of their energies. Noteworthy among these Scriptures was the Cologne Bible, which appeared in 1478–1479 and contained 109 designs, the first illustrations of the Scriptures to appear after the block books. Along with the Bibles, numerous "chronicles" and histories became popular; these were conceived as records of legends dealing with the lives of the saints and great or imaginary happenings in local history. One of the best known of these chronicles was published at Nürnberg in 1493. The work, which has more than 2,000 cuts (views of cities, portraits of saints, and so on), is said to have been supervised by William Pleydenwurff (d. 1494) and Michel Wohlgemuth (1434–1519), the latter a teacher of Dürer.

In France, woodcut was early identified with printing. Religious books contained beautiful and painstakingly wrought illustrations. Those known as the *livres d'heures* (books of hours) are most notable. Often the prints were hand colored and decorated with gold, and the books were further enhanced by decorative borders. See also *Book of Hours*.

The woodcut was introduced to Italy by German printers, and Venice became an important center of the art. The most noted example of early Italian woodcut is in the *Hypnerotomachia Poliphili* (Dream of Poliphilo), written by Francesco Colonna in 1467 and printed by the famous Aldus Manutius (1450–1515) in Venice in 1499. The work has 192 woodcuts.

**Dürer and Holbein.**—The genius of Albrecht Dürer (q.v.) brought woodcut to its highest achievement. He was a draftsman as well as a

craftsman, with a far-reaching and powerful imagination and a thorough knowledge of the new spirit of approaching reformation. He was the first to realize fully the possibilities of woodcut, and by his influence he raised it to the realm of a fine art. Among his greatest accomplishments were the 15 compositions to illustrate the *Apocalypse of St. John* (1498), and the *Large Passion of Our Lord*, with 12 cuts, of which 7 were executed in 1498, the remainder being finished in 1510 and the set being published with the Latin text in 1511. The *Life of the Virgin*, with 20 cuts, falls entirely within the first decade of the 16th century and was printed on Dürer's printing press in 1511. The *Small Passion of Our Lord* (1511), which has 37 prints, is equally famous.

Dürer's great talent and masterly use of the burin in woodcut gave rise to a school of artists known as the "Little Masters," whose work created a renaissance in decorative and religious subjects. They included Hans Sebald Beham (1500-1550), Hans Baldung (1476?-1545), Heinrich Aldegrever (1502?-1560), and Jost Amman (1539-1591).

The great number of woodcuts known to be by Hans Holbein the Younger (1497?-1543) are too numerous to attempt mention of them individually. There is no doubt that Holbein knew the technique of woodcut; however, it has been established that Hans Lützelburger, with his profound understanding of the art of engraving and woodcut, knew how to interpret every meaning of Holbein's drawings. Among the first books Holbein illustrated were the *Utopia* of Sir Thomas More and Biblical translations of Martin Luther. The *Dance of Death* series of 1538, containing 41 small cuts, is considered the most famous of all interpretations of this popular subject. Although measuring only 2 by 3 inches, they display extraordinary power of observation combined with great simplicity of composition and draftsmanship. People in all walks of life, from the king and queen to the fool who tries to escape death, are represented in this series. Holbein's *Alphabet of Death* and 86 designs for the Old Testament, along with many other book illustrations, must be considered on the same plane of creation and workmanship as the above-mentioned series.

Early in the 16th century, both the German Jost de Negker (1485-1544) and the Italian Ugo da Carpi (c. 1455-c. 1523) claimed to have invented the chiaroscuro print, a process by which color effects were gained through the use of several blocks to produce tones, printing one over the other. It is now recognized that the technique originated in Germany and that da Carpi, who coined the term *chiaroscuro*, contributed improvements in the new method. He produced several of Raphael's compositions by this technique, and in Germany impressions were made from the designs of Johann (Hans) Wechtlin (1460-1526), Hans Burgkmair (1473-1531), Lucas Cranach the Elder (1472-1553), Hans Baldung, and other artists.

During the 17th and 18th centuries the art of woodcut and wood engraving was overshadowed by the development of copper engraving as a means of reproducing original works of art. Little of technical or artistic innovation dates from this period. The mediums of woodcut and wood engraving continued to be used, but chiefly as a means of illustrating cheap, popular types of books, journals, and broadsides.

**Bewick and the 19th Century Revival.**—A revival in wood engraving began with the work of Thomas Bewick (1753-1828) in England. To him we owe the bringing into general use of the technique of white-line engraving, which eliminated the old method of cutting the wood away from the lines. He was the first, or one of the first, to use boxwood and the burin. Bewick is best known by his engravings for the *General History of British Quadrupeds* (1790) and *History of British Birds* (2 vols., 1797, 1804). He was the founder of the modern British school which held a distinguished place in modern illustrative art, and which included Charlton Nesbit (1775-1838), Luke Clennell (1781-1840), Allen Robert Branton (1778-1827), John Thompson (1785-1866), Edward Dalziel (1817-1905), George Dalziel (1815-1902), William Harvey (1796-1866), and William James Linton (1812-1897). In 1820 the artist-poet William Blake designed 13 woodcuts for Robert John Thorton's *School Virgil* (*Bucolics*), published with Blake's designs as *Illustrations of the School Virgil* (1824). These small blocks, although crude in technical handling, have powerful design and much pastoral charm. A great accomplishment of the later 19th century in England was the *Kelmscott Chaucer*, published in Hammersmith in 1896 under the direction of William Morris. This book was one of the most impressively designed and illustrated volumes produced since the decline of printing in Venice; it contains illustrations engraved in wood by William Hooper (1834-1912), after designs by Sir Edward Coley Burne-Jones. Other fine engravers of this period are Charles Ricketts (1866-1931), Charles Shannon (1863-1937), and Thomas Sturge Moore (1870-1944).

In Germany, where the art of wood engraving was long in decline, a new life was developed late in the 18th century by Johann Georg Unger (1715-1788) and his son, Johann Friedrich Unger (1753-1804). Adolph F. E. von Menzel (1815-1905) trained Hans Alexander Mueller (1888- ), Eduard Kretzchnar (1807-1859), and Friedrich L. Uzelmann (1797-1854) to reproduce his work.

From rather primitive beginnings, engraving in the United States was rapidly developed into a highly commercial reproductive art of a technical excellence unrivaled by similar efforts in other countries. By the second half of the 19th century such firms as Harper & Brothers, Charles Scribner's Sons, and the Century Publishing Company were among the leading publishing houses to make extensive use of wood engraving for illustrations in their books and periodicals. The drawings and paintings of many well-known artists, such as Winslow Homer, were made popular by black-and-white engravings which appeared regularly for a period of years in *Harper's Weekly*. These were first done by the old style of wood engraving, with the drawings carried by the black lines against the white background, but later in the 19th century a refinement of the Bewick system, using the white line to define the forms and carry the drawing, came into use. The cutting of these blocks was done according to strict conventions, carried to a degree of precision seldom attempted before. The use of a multiple graver and the use of stippling aided in evolving this manner, which sought to reproduce original works and photographs with a close fidelity to the spirit of the original. The blocks were cut on the end grain of the wood and were capable of printing

thousands of identical impressions quickly and cheaply. This type of engraving became known as the "New School of Engraving," whose more notable members included Timothy Cole (1852-1931), Henry Wolf (1852-1916), Gustav Kruell (1843-1907), T. A. Brothers, William James Linton (who had gone to the United States in 1866), Ernst Schladitz, and Hiram C. Merrill (1867-1958). Cole was perhaps the most accomplished of this group. The greater part of his output consisted of black-and-white translations of well-known paintings by European old masters. Within the limitations imposed by the medium, Cole's technique often suggested color values and usually gave an over-all effect of a rich and sensitive interpretation of the original.

With the introduction of modern means of photoengraving and the halftone process during the closing years of the 19th century, the veritable armies of commercial engravers who had done mass production work for the newspapers and publishing firms were no longer needed. This brought about a gradual disuse of this highly developed, commercial method of engraving.

Even before this transition was well under way in the United States, certain French artists such as Félix Vallotton (1865-1925), Louis Auguste Lepère (1849-1918), and Paul Gauguin (1848-1903), were working independently along divergent paths which were to be recognized eventually as the start of a renewed interest in original creative work in the mediums of woodcut and wood engraving. They were among the first to make use of these mediums in a more truly individual way than had been attempted previously. Of the three, Gauguin had the greatest influence on the present day approach to the woodcut. His style was characterized by an intensity of personal expression, both in his choice of subject matter and in his cutting technique. Both line work and irregular black-and-white design elements were sometimes combined with one or more colors to heighten the symbolic character of the work as a whole. Although not fully understood or appreciated during his lifetime, or for some years thereafter, his use of the woodcut as an original artistic medium proved to be a strong influence on Edvard Munch (1863-1944) of Norway. This artist carried Gauguin's concept of color as a dramatic element a step further and used the subtle variations of the natural grain of the wood to produce effects of great power and imagination. Like Gauguin, Munch cut on the plank side of the wood, often creating prints of large dimensions.

**The 20th Century.**—Beginning in 1905, a group of artists who have been since referred to as the German expressionists began to make woodcuts which were inspired by the bold, dramatic approach initiated by Gauguin and Munch. Their work is dominated by subjects which reflect deeply felt emotions. Their technique, though spontaneous in appearance, is combined with a strong sense of design and controlled by drawing of an unadorned directness. Foremost in this group were Emil Nolde (1867-1956), Max Pechstein (1881-1955), Karl Schmidt-Rottluff (1884- ), Ernst Ludwig Kirchner (1880-1938), Max Beckman (1884-1950), and Erich Heckel (1883- ). Käthe Kollwitz (1867-1945), working somewhat independently, also produced woodcuts of great power and depth. Their work as a whole reveals a subjective reaction to the social upheaval and political violence which swept

over much of Europe during this period. Natural forms were purposefully exaggerated and distorted to produce shocking emotional impact. Patterns of black and white and the use of strong tonal contrasts which often incorporated stark colors are typical. Also working in Germany, although somewhat apart from the main movement of this period, was Ernst Barlach (1870-1938), who was devoutly occupied with religious subjects. He evolved a stylistic idiom of his own which recalled certain aspects of the German woodcuts of the 15th and 16th centuries.

Early 20th century woodcut and wood engraving in France took many diverse forms. The reputation of the French work stems more from its examples of high quality of individual achievement than from the formation of a definite school such as that of the German expressionists. Much of the best work in France in woodcut and wood engraving during the present century has been done as illustration for the fine published literary works which have appeared in handsomely bound limited editions. Outstanding among these are the woodcuts of Aristide Maillol (1861-1944) for *Daphnis et Chloë* (new ed. 1949). Eminent artists such as Pablo Picasso (1881- ) and Georges Rouault (1871-1958) produced designs which were engraved by others as plates for a number of publications of Ambroise Vollard. Other artists working in France at this time were Jean Émile Laboureur (1877-1943), Raoul Dufy (1877-1953), and Démétrios Galanis (1882- ).

Mention should be made of the woodcuts of Wassily Kandinsky (1866-1944). This artist, of Russian origin, created a number of prints which combine the mediums of woodcut and wood engraving, and his compositions are among the finest examples of abstract art yet to be seen in any medium.

Significant earlier 20th century American wood engraving and woodcut may be found in the prints of Rockwell Kent (1882- ), Thomas Nason (1889- ), Asa Cheffetz (1896- ), Julius J. Lankes (1884- ), Paul Landacre (1893- ), and Lynd Ward (1905- ). Their subjects deal primarily with the American scene in a regional sense. The blocks are executed in the traditional techniques, based on the standards of fine workmanship established by the reproductive engravers of the late 19th century. There are, however, definite personal variations in their cutting methods, along with an originality of subject and a freedom of handling not found in the earlier period. Kent is noted for the literary character of his work as well as for his mastery of design and technique. Much of his output appears as illustrative material in fine published works written by Kent himself. Ward's keen analysis and sensitive feeling for his subject may be found in *God's Man* (1929), *Madman's Drum* (1930), *Wild Pilgrimage* (1932), *Song Without Words* (1936), and *Vertigo* (1937), all of which are symbolic narratives related entirely through the medium of woodcuts, without the aid of written texts.

Mid-20th century American woodcut and wood engraving exhibits a still greater departure from tradition. Much of the work has been conceived with a great deal of vitality and inventiveness. The styles in use reflect a somewhat eclectic mixture of influences which may be traced back to German expressionism, abstract art, and also primitive art, in various combinations. Unusual color effects and tonal nuances have been introduced. Prints have become increasingly larger in

size and more striking in character, serving more often as wall decoration than as book illustration. Although the tools of the medium have not changed greatly, the possibilities of technical variation have been explored as regards cutting and printing methods. There has been a rapid exchange and interaction of influences between artists the world over. Styles and techniques have become less limited to national boundaries, and a distinctly international character is evident in prints done since the end of World War II. American prints representative of these developments are found in the work of Antonio Frasconi (1919- ), Misch Kohn (1916- ), Louis Schanker (1903- ), Seong Moy (1916- ), Leonard Baskin (1921- ), Adja Yunkers (1900- ), Rudy Pozzati (1922- ), and many others. At the same time, the more traditional methods and more conservative styles continue to be practiced by such artists as Fritz Eichenberg (1901- ), Grace Albee (1890- ), Nora Unwin (1907- ), Clare Leighton (1901- ), Letterio Calapai (1925- ), and Hans Jelinek (1910- ).

Engraving in England in the 20th century has flourished, notably under such artists as Eric Gill (1882-1940), Paul Nash (1889-1946), John Nash (1893- ), Gwendolen Raverat (1885-1925), and Charles F. Tunnicliffe (1901- ).

**Japanese Woodcuts.**—The Japanese woodcut has influenced contemporary artists working in the medium in Europe and the United States for several generations. Early Japanese art was linked to the culture of China, particularly in the visual arts. The Japanese learned the same techniques in the application of color and use of line as were employed by the Chinese in their paintings. Since the Japanese artists devoted themselves principally to the problem of decorative composition, it was a natural step to the color woodcut, on which they concentrated much of their genius. The line supplied the drawing, detail, form, and structure. This, coupled with the Japanese tradition of craftsmanship and sensitive interpretation in supporting the line with color, resulted in masterpieces which are now universally known. The leading masters of the school of Ukiyo-e, which flourished during the Edo period (c. 1615-1867), and those who contributed most to the development of the color woodcut were: Moronobu Hishikawa (1618-1694), Harunobu Suzuki (1725-1770), Kiyonaga Torii (1752-1815), Utamaro Kitagawa (1753-1806), Hokusai Katsushika (1760-1849), and Hiroshige Utagawa (Ando Hiroshige, 1797-1858); there were also other masters of lesser importance. Their innate sense and inherent passion for design and composition were demonstrated in their power to illustrate fully the poetry and mystery of their artistic heritage. The tools, and methods of using them, differed little from those used by the early European masters, but there was a vast difference in the printing from the block.

The method of transferring the original drawing to the block varied slightly from contemporary practice. The face of the block was covered with a thin coating of rice paste; the tracing from the drawing was then placed, face down, on the prepared surface and secured thoroughly by rubbing with a baren.<sup>1</sup> When dry, the block, usually of

cherry wood, was ready for cutting, with the knife interpreting the line work of the original drawing. When completed, this was known as the key block since it controlled the registration marks on the color blocks that followed.

The first step in printing was the preparation of the paper. Japanese rice papers, usually Torinoko or Hosho, were ideal for woodcuts because of their absorbent quality and capacity to receive color and the grain of the wood, if desired. The paper was first sized with thin gelatin and then dampened evenly and to the right degree with a soft brush. The block was wet with a sponge and made ready to receive the water color, which was mixed to the desired intensity according to the chosen color scheme. The colors were painted on with a comparatively dry brush in several directions on the block in order to ensure even, flat tones, if desired. To print gradations of color, one end of a wide moistened brush was charged with color and applied in the required direction. In the hands of an expert the color gradated itself and even diminished to a very light tone onto the white unpainted areas.

The number of colors used determined the number of blocks, which were all printed separately in sequence while the paper was still damp. This was necessary so that all states would register correctly. The key block, printed in black india ink, was the last to be made, and pulled the color impressions together into a well-coordinated whole. Some artists printed the key block first to facilitate registration.

The color and key blocks were transferred to the paper by rubbing the baren with the grain of the wood in an even or increasing pressure, according to the required result. The prints were then dried between weighted drying boards which were thick enough to absorb the remaining dampness in the print.

See also BOOK; ILLUSTRATION OF BOOKS; and biographies of the prominent artists mentioned.

ARTHUR W. HEINTZELMAN,

*Keeper of Prints, Boston Public Library.*

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**WOOD FINISHING.** See WOODWORKING.

**WOOD GREEN**, municipal borough, England, in Middlesex, 7 miles north of London's St. Paul's Cathedral. It is a residential borough in the suburban area of Greater London, chartered in 1933, and containing within its boundaries most of Alexandra Park and Alexandra Palace. The

<sup>1</sup>A thin disk of stiff paper of papier-mâché on which a coil or mat of tightly braided fiber was fitted. This was encased in an unblemished bamboo leaf, which formed a hard, smooth surface for printing. The ends of the leaf were twisted on the reverse side to secure the rubbing surface and to form a convenient handle.



New River, an artificial waterway constructed in 1609, flows through the borough. The British Broadcasting Corporation maintains a television news studio here. Pop. (1961) 47,897.

**WOOD HEWER**, a bird of the family Dendrocolaptidae, restricted to the forests of the New World from Mexico south to Argentina. The family numbers nearly 50 species and is best represented in the Amazon Basin. Wood hewers are medium-sized or small birds, ranging in size from that of a dove to that of a wren, and have a brown or grayish plumage, spotted or streaked with black, white, or buff, and with reddish areas in the wing and tail. The wood hewers are not related to the true tree creeper (family Certhiidae) although their habits are very similar, inasmuch as they are constantly searching and probing the crevices or the bark of trees for insects. The hewers are well adapted to this mode of life: the tips of their tail feathers are stiffened for support and sometimes end in spines, as in the woodpeckers; and they have very strong toes and claws and, usually, a long, slender bill. The term "hewer" is misleading, as the birds, though they may pry off bits of bark or moss, do not chop into the tree.

CHARLES VAURIE.

**WOOD IBIS.** See STORKS.

**WOOD LARK**, a characteristic songbird (*Lullula arborea*) of western Eurasia, which breeds also in northwestern Africa. It is about six inches in length, with a streaked plumage, and resembles the more familiar skylark to which it is closely related. It differs from it, however, in being more richly colored with a more strongly contrasting pattern, and by frequenting regions interspersed with scattered trees on which it often perches, whereas the skylark is strictly terrestrial and avoids regions or sites where there are trees. The male wood lark rises to sing and descends with a more circular spiraling flight than that of the skylark. The wood lark breeds from Great Britain eastward to the Ural Mountains, Turkmen SSR, and Iran, and south to Morocco, Algeria, and Tunisia.

CHARLES VAURIE.

**WOOD LOUSE** (also called **PILL BUG** and **SOW BUG**), a small terrestrial animal with some resemblance and relationship to lice or bugs (which are insects), but belonging to a group of crustaceans known as Isopoda, which also contains aquatic members. The terrestrial members live under fallen logs and bottom debris in humid woods, and also in gardens under stones, boards, flowerpots, and the like. The wood louse is a small, gray, flattened creature with a jointed body and a pair of feelers (antennae) and compound sessile eyes at the anterior end. Each of the first seven body joints, constituting the thorax, bears on its underside a pair of walking legs. The following smaller abdominal joints have flat respiratory plates on their undersurface. (Isopods are primarily aquatic, but some have adapted to terrestrial life by developing the respiratory plates, which may contain a pair of air tubules like the tracheae of insects.) The sexes are separate; after mating, the female carries the developing eggs in a brood pouch (on the underside of the thorax) formed by overlapping plates borne on the bases of the

first five pairs of legs. Here the eggs develop into fully formed young which are like the adults except in size. Isopods feed primarily on decaying organic material, and are of small economic importance. Most of the species seen in woods and gardens are importations from Europe; they have become distributed throughout the world by way of plant shipments. See also ISOPODA.

LIBBIE H. HYMAN.

**WOOD NYMPHS** (sometimes called **DRYADS** or **HAMADRYADS**), in classical mythology, those among the lesser goddesses known as nymphs who made their homes in forests and trees. See NYMPHS.

**WOOD OIL.** See ALEURITES; TUNG OIL.

**WOOD PEWEE**, wōd pē'wē, the name of two small flycatchers of the family Tyrannidae. This family is found only in the Americas, and the better known of the two species, the eastern wood pewee (*Contopus virens*), breeds only in Canada and the United States. The western wood pewee (*C. sordidulus*) breeds in the western part of the continent from Alaska to northwestern Mexico. The two birds are about 6½ inches in length and dull and inconspicuous in coloration. They are grayish olive above with a whitish throat, a gray breast, and pale abdomen. They are not true songbirds in the technical sense, but nevertheless have a very pleasing voice. The notes of the eastern wood pewee are slurred and plaintive, with a regular pattern; those of its western relative are whistled and given forth more rapidly. The difference in the voice is the chief distinguishing feature between the two species. As their name indicates, both pewees inhabit the woodlands. See also PEWEE.

CHARLES VAURIE.

**WOOD PIGEON**, a well-known pigeon (*Columba palumbus*) of the Old World, of the family Columbidae. It breeds in the Azores, Madeira, and from northern Africa and Europe eastward to the province of Sinkiang, China, and the Himalaya. It is about 16 inches in length and heavily built, bluish-gray, and somewhat similar to the domestic pigeon, from which it differs, however, by having a conspicuous white patch at the sides of the neck and a broad white band on the wing. It normally frequents woodlands but is a familiar sight in the parks of even the largest cities, such as London or Paris, where it has become very tame. It is omnivorous and in certain regions is often quite destructive of crops. See also COLUMBIDAE; PIGEON.

CHARLES VAURIE.

**WOOD PULP.** See CHEMICAL INDUSTRIES—*Pulp and Paper*; PAPER; WOOD—6. *Wood Chemistry Products* (Wood Pulp and Products).

**WOOD RAT**, a rat-like wild rodent (*Neotoma*), native to much of the United States. The head and body are six to nine inches in length and the tail nearly as long. The coat is soft-textured and gray or brownish, the under surface gray or white, the tail hairy (not scaly), and the ears large and thin. All species accumulate sticks and debris as nests. Eastern species favor cliffs for shelter; plains or desert wood rats make rounded nests two to four feet high amid cactus, yucca, or brush; the bushy-tailed species of the Western

mountains inhabit cliffs or rock slides; and the dusky-footed wood rat of California makes nests in live oaks.

These animals are often called pack rats, because they commonly take tableware or other bright objects from camps or cabins; they are also known as trade rats since they sometimes leave bits of debris, as if in exchange.

TRACY I. STORER.

**WOOD-RIDGE**, borough, New Jersey, in Bergen County, 3 miles southeast of Passaic and 8 miles northeast of Newark. The community is mainly residential, though aircraft engines are manufactured. The area was part of a large tract of land granted by the provincial New Jersey governor, Philip Carteret, to Capt. John Berry in 1669. It was subsequently divided into farms and in the early part of the 19th century settled by farm workers. The borough was incorporated in 1894 and is administered by a mayor and a council. Population: 7,506.

**WOOD RIVER**, city, Illinois, in Madison County on the east bank of the Mississippi River, 16 miles north-northeast of downtown St. Louis, Mo., and 6 miles southeast of Alton, Ill. It is an industrial community, and was established in 1907 as the site of a large oil refinery; it has since acquired a tank-car shop and pipeline terminals. Located nearby, at the mouth of the Wood River during the winter of 1803-1804, is the site of the encampment where Meriwether Lewis and William Clark recruited and trained members of the expedition which was to explore the Pacific Northwest. Incorporated as a village in 1911, and as a city in 1923, Wood River has had a council-manager government since 1953. Population: 11,490.

**WOOD SCULPTURE.** See WOOD CARVING.

**WOOD SORREL**, the colloquial name of various species of plants in the genus *Oxalis*, especially *O. acetosella*. Technically, the term sorrel refers to the acid sap, which is protective against slugs. *O. acetosella*, the white wood sorrel, one of the plants sometimes called shamrock, is widely distributed in rich woodlands in temperate North America, Europe, and Asia. It has trifoliate leaves and five white petals, about ½ inch in length, with pink veins; rose-colored forms also occur. *O. violacea*, the violet wood sorrel of North America, has purple petals ½ inch long, and is bulbous at the base. A number of ill-defined, widely distributed species of yellow wood sorrel, with small flowers less than ½ inch long, occur as common weeds, including *O. stricta*, which is a native of the New World, and *O. corniculata*, of the Old World. Some of the more showy wood sorrels are cultivated, such as *O. Bowiei* of South Africa, which has rose-colored flowers nearly 2 inches in diameter. See also OXALIS.

EDWIN B. MATZKE.

**WOOD SWALLOW**, a songbird of the family Artamidae. The family consists of 10 species distributed from India and the Philippine Islands to Fiji and Australia. The family is most abundant in Australia where six of its species are found. Their nearest relatives are uncertain but may consist of the shrikes and waxwings, not the swallows, to which, however, they bear a super-

ficial resemblance in that they are long-winged and are very agile flyers which feed chiefly on insects caught on the wing. The wood swallows vary in length from about six to eight inches and are all plainly colored, being usually soft gray above. They build a very frail nest of grasses and twigs, usually placed in a tree.

CHARLES VAURIE.

**WOOD THRUSH**, a familiar thrush (*Hylocichla mustelina*) of eastern and central North America. It is eight inches in length and reddish brown above with many large, rounded, blackish spots below on a whitish background. The song is always beautiful and liquid, with a flutelike quality best appreciated at dusk, from some distance. The wood thrush's most favored habitat is deciduous woods, especially when moist and with dense undergrowth, but it has spread also to more open or built-up areas, including the suburbs of the largest cities, provided it can find shaded lawns with dense shrubbery. The breeding range extends from southeastern South Dakota and central Minnesota east to southern Quebec and south to Texas, Louisiana, and northern Florida. It is migratory, wintering from southern Texas and Mexico to Panama.

See also THRUSH.

CHARLES VAURIE.

Wood thrush (*Hylocichla mustelina*). Its song is considered the finest of any American bird's.

Allan D. Cruickshank from National Audubon Society



**WOOD WARBLER.** See **WARBLER**—*New World Warblers* (*Wood Warblers*).

**WOODBERRY**, wōd'bēr-ē, **George Edward**, American critic, poet, and educator: b. Beverly, Mass., May 12, 1855; d. there, Jan. 2, 1930. After graduating from Harvard in 1877, he taught English at the University of Nebraska for a time, became a frequent contributor to the *Atlantic Monthly* and the *Nation*, and was literary editor of the *Boston Post* in 1888. His *Life of Edgar Allan Poe* (1885; enl. ed., 2 vols., 1909) brought him recognition as a literary biographer and critic of the first quality, and remains a classic. A first book of poems, *The North Shore Watch and Other Poems* (1890), and a collection of essays, *Studies in Letters and Life* (1890), contributed further to his reputation. Appointed professor of literature at Columbia University (1891) and subsequently professor of comparative literature (1900), Woodberry was an outstanding teacher who generated enthusiasm for literature in his students and did much to encourage undergraduate writing. He also strove to liberalize graduate literary studies, and initiated and edited the pioneering series *Columbia University Studies in Comparative Literature* (9 vols., 1899–1903). During this time he published *Wild Eden* (1899), a book of lyric verse; *Heart of Man* (1899), a collection of essays relating the imaginative aspects of poetry, politics, and religion; and *Nathaniel Hawthorne* (1902), a biography which took its place as a classic beside his work on Edgar Allan Poe.

Woodberry resigned his position at Columbia in 1904, but continued to lecture from time to time at various universities in the United States and traveled in the Mediterranean region. Collections of essays based on his lectures were published, notably *The Torch* (1905), which presented his philosophy of literature in the New England transcendentalist tradition. *Ralph Waldo Emerson* (1907) was another important critical biography. *Ideal Passion* (1917), a collection of sonnets showing the influence of his travels in the Mediterranean, and *The Roamer and Other Poems* (1920), a collection of most of his poetry, were the major publications of his later years. Woodberry also edited *The Complete Poetical Works of Percy Bysshe Shelley* (4 vols., 1892) and, with Edmund C. Stedman, *The Works of Edgar Allan Poe* (10 vols., 1894–95).

ROSAMOND MUELLER.

**WOODBINE.** See **VIRGINIA CREEPER**.

**WOODBURY**, wōd'bŭrij, **Frederick James Eugene**, American educator and philosopher: b. Windsor, Ontario, Canada, March 26, 1867; d. New York, N.Y., June 1, 1940. He graduated from Amherst College (1889) and Union Theological Seminary (1892), and studied subsequently at the University of Berlin. After teaching at the University of Minnesota from 1894, he began his distinguished association with Columbia University, where he was appointed professor of philosophy in 1902. Two years later he became the first Johnsonian professor and from 1912 served also as dean of the graduate faculties, introducing a program of graduate research which contributed much to Columbia's outstanding position among American universities. He stayed on as professor for another decade after resigning as dean in 1929. Woodbridge was cofounder of

the *Journal of Philosophy, Psychology, and Scientific Method* (1904; renamed the *Journal of Philosophy*, 1920), which he edited for the rest of his life, and was a leading spokesman of the emerging realist movement in American philosophy, with its roots in the Aristotelian tradition. His books include *The Philosophy of Hobbes*, (1903), *The Realm of Mind* (1926), and *Nature and Mind* (1937). *Contrasts in Education* (1929) presents his philosophy in that field.

**WOODBIDGE**, town, Connecticut, in New Haven County, adjacent to the city of New Haven on the west. The town is mostly residential, with agriculture the chief economic activity. Formed from parts of New Haven and Milford, it was incorporated in 1784. Its government is by town meeting, selectmen and -women, and a board of finance. Population: 7,924.

ROBERT C. SALE.

**WOODBIDGE**, township, New Jersey, in Middlesex County, just north of Perth Amboy, across the Arthur Kill channel from Staten Island. Clay deposits have fostered industry in terra cotta, tile, bricks, and ceramics. Other industrial activity includes boatyards and the manufacture of chemicals, soft beverages, office equipment, dairy products, and brewery supplies. The site was settled in 1665 by John Woodbridge and other Puritans from Massachusetts Bay and New Hampshire, and the township was incorporated four years later. The first printing press in New Jersey was established here in 1751 by James Parker, but his periodical, the *American Magazine*, soon failed. Woodbridge was a popular watering place in the 1880's. It includes the villages of Fords, Sewaren, Hopelawn, Port Reading, Keasbey, Colonia, Iselin, Avenel, and Menlo Park Terrace. Government is by mayor and council. Population: 93,086.

**WOODBIDGE**, a community in the town of Vaughan, Ontario, Canada, in the regional municipality of York. It is on the Humber River, near the confluence with the East Branch, 1.5 miles (2.4 km) north of Toronto. Woodbridge was founded early in the 19th century as a millsite and service center for the adjacent agricultural area of Vaughan Township and was incorporated as a village in 1882. The Woodbridge agricultural fall fair was long one of the largest and best attended in the province. Archaeologists uncovered the site of an Indian village nearby. Woodbridge became part of the town of Vaughan in 1971.

D. F. PUTNAM\*, *University of Toronto*

**WOODBURY**, wōd'bŭr-ē, **Charles Herbert**, American artist: b. Lynn, Mass., July 14, 1864; d. Boston, Jan. 21, 1940. A graduate of the Massachusetts Institute of Technology (1886), he studied art in Paris at the Académie Julien and later established himself in the Boston area as a marine painter and teacher. For many years he conducted a summer school at Ogunquit, Me., whose setting inspired many of his seascapes. Among his paintings are *Ogunquit, Maine* (Metropolitan Museum of Art, New York City), *The North Atlantic* (Worcester, Mass., Art Museum), *Off the Florida Coast* (Museum of Fine Arts, Boston), *Mid-Ocean, A Heavy Sea, Maine Coast*, and *The Ground Swell*. He wrote *Painting and the Personal Equation*, with E. W. Perkins (1922), and *The Art of Seeing* (1925).

**WOODBURY, Levi**, American cabinet officer and justice of the Supreme Court: b. Francetown, N.H., Dec. 22, 1789; d. Portsmouth, Sept. 4, 1851. Graduated from Dartmouth in 1809, he was admitted to the bar in 1812 and practiced at Francetown and Portsmouth until his election as clerk of the state Senate in 1816. The following year he was named associate justice of the state Superior Court and in 1823-1824 was governor. Woodbury represented New Hampshire in the United States Senate from 1825 to 1831, when he joined Andrew Jackson's cabinet as secretary of the navy. In 1834 he became secretary of the treasury and proved to be a formidable fighter for an independent federal Treasury and a vigorous supporter of Jackson's successful campaign against the Bank of the United States. Woodbury remained at the Treasury through the administration of Martin Van Buren, and upon retiring from office in 1841 he was reelected to the federal Senate. In 1845 President James K. Polk appointed him associate justice of the United States Supreme Court. On the bench he upheld the states' rights doctrine on the question of slavery, although he was personally opposed to slavery itself. He was also a vigorous advocate of free public education, systematic teacher training, and public facilities for adult education. *The Writings of Hon. Levi Woodbury, Political, Judicial, and Literary* was brought out posthumously by Nahum Capen (3 vols., 1852).

**WOODBURY, Walter Bentley**, English photographer and inventor: b. Manchester, England, June 26, 1834; d. Margate, Sept. 5, 1885. The lure of the goldfields drew him in 1852 to Australia, where he practiced his hobby of photography in Melbourne. After moving to Java in 1858, he achieved good results with the recently developed wet collodion process. Returning to England in 1863, he established himself in Birmingham and in the following year invented a new method of photoengraving which came to be known as the woodburytype process (patented July 24, 1866). He subsequently took out more than 20 patents on various photographic devices and techniques of photomechanical printing. See also WOODBURYTYPE PRINTING.

**WOODBURY**, city, New Jersey, seat of Gloucester County, on Woodbury Creek, eight miles southwest of Camden. Located in a rapidly growing suburban area, the city is primarily residential with a few local industries, including the manufacture of cement products, clothing, and electrical precision parts. It is also a cultural center, with a symphony orchestra, a choral society, and art and drama groups. Several notable 18th century buildings survive, including the boyhood home of Capt. James Lawrence (q.v.); the Cooper House, used as a headquarters by Earl Cornwallis before the Battle of Red Bank (1777); and the Friends' Meeting House. Woodbury was settled in 1681 by the Wood family, Quakers from Bury, England; it was incorporated as a borough in 1854 and as a city in 1871. It has a mayor-council government. Population: 10,904.

RUTH W. LINDEROTH.

**WOODBURYTYPE PRINTING**, wōd'bēr-ē-tīp prīn'ting, a photogelatin process, one of the early methods of photomechanical reproduction. Although it provided excellent printed copies of photographs, it is primarily of historic interest

today. It was developed by Walter Bentley Woodbury (q.v.) and first shown by him in 1866 in the *Photographic News*. The process relies on the change of the solubility of bichromated gelatin when exposed to light.

To make the woodburytype printing plate, the image to be reproduced must first be obtained in a photographic negative as is done in other processes of photomechanical reproduction. Next a relief image or mold must be made; to do this, a layer of bichromated gelatin is exposed to light through the photographic image or film. Where unobstructed light reaches the gelatin, it is rendered highly insoluble; where no light comes through, it remains soluble; and as the light varies between these extremes, so is the solubility affected. The gelatin is then placed in warm water, and a relief image is produced by washing away the soluble gelatin. The remaining gelatin is hardened in a solution of chrome alum, and the completed mold is achieved, a hardened, washed-out gelatin relief, which, when impressed in type metal under great pressure, produces an intaglio (q.v.) metal plate. Since the gelatin mold is considerably harder than type metal, many printing plates can be made from a single mold.

The metal plate must be lightly oiled before printing. It is then filled with pigmented gelatin. Smooth paper, specially treated with varnish, is held under firm impression a few minutes until the gelatin sets; upon removal of the paper, the film of gelatin adheres to it. An excellent, crisp reproduction results. Actually the reproduction achieved is a replica of the original gelatin mold in a very thin film of pigmented gelatin. The dark areas are thickest, and the highlights are thinnest. In normal production the long wait for the gelatin to set under impression was offset by having one pressman attend several presses in rotation. The process was greatly limited as to size, the maximum being about a foot square. The presses were thus small and of the type used for simple copying.

Woodburytypes, as such reproductions came to be known, were produced in the United States, England, France, and Germany. In his annotated catalog (1892) of the Boston Museum of Fine Arts' Exhibition Illustrating the Technical Methods of the Reproductive Arts, Sylvester R. Koehler described the process as one that "gives very beautiful results, but unfortunately the prints are apt to become brittle, from drying-out, and to chip off." This brittleness is noticeable in surviving prints.

It is notable that the collotype, which was developed at about the same time as Woodbury's process, also used bichromated gelatin. But in making use of the degree of solubility of the treated gelatin, collotype applies this characteristic to the principle that oil and water do not readily mix and, as in lithography, moistens the gelatin film before inking. According to the degree of solubility, the gelatin collotype plate then accepts or rejects ink, recreating the image desired. Collotype today, of all reproduction methods, produces the greatest range of tone in the gray scale and is widely used. See also LITHOGRAPHY—Related Processes.

Slowness of production, fragility of prints, and improvement of quality in other cheaper, faster processes have led to virtual disuse of woodburytype printing.

BRUCE GENTRY,  
Graphic Arts Consultant.

**WOODCARVING.** See WOOD CARVING.

**WOODCHAT**, wōd'chāt, a name common both to an Asiatic bird of the thrush family (Turdidae) and to a European bird of the shrike family (Laniidae). The Asiatic woodchat is represented in the genera *Lanthia* and *Larvivora*, whose habitat is western Asia. The males are mostly bright blue but have red or rufous markings on the under parts. The European woodchat (sometimes called the woodchat shrike) belongs to the species *Lanius rutilus* (sometimes designated *L. senator*), whose habitat is southern Europe, where it appears in dry and open country, bushy commons, orchards, and olive groves. The woodchat is about seven inches long, its bill is hook tipped, its behavior is hawklike, and its song is musical, though interspersed with harsh notes. Though a rich chestnut-red color appears on the crown of the head and on the nape of the neck, both sexes are mostly black on the upper parts and white on the under parts and have some white on wings and tail.

DEAN AMADON.

**WOODCHUCK**, wōd'chūk, or **GROUNDHOG**, ground'hōg, an American marmot (*Marmota monax*), 20 to 27 inches long, grizzled brown above and lighter below, the feet and tail blackish. It is found in the United States from the Atlantic coast to the Mississippi Valley (except in the Gulf states) and in Canada across the continent and as far north as Alaska, several distinct subspecies occurring in this wide range. Other related species of marmots are found west of the Rocky Mountains in North America, Europe, and Asia.

Woodchucks dig their holes in the fields, on sides of hills, or under rocks in the woods, in a slanting direction, at first upward to keep out the water, with several compartments, and usually

with more than one entrance. Winter is passed in this burrow, in a dormant state. The digging is effected by the powerful forefeet, assisted by the front teeth, the dirt being thrown backward under the belly and then kicked out by the outspread hindfeet. The food of the woodchuck consists of various plants, fruits, and vegetables, clover being particularly favored. As a result, the animal sometimes does considerable damage to both crops and gardens.

Woodchucks feed chiefly during early morning and late afternoon, and spend most of the remaining time lying in the sun or sleeping in the nests at the bottom of their burrows. They become extremely fat (weighing up to 14 pounds in the autumn), retire to hibernate on the first intimation of winter (usually two to four marmots co-hibernate in one den), and reappear after the snow has gone in the spring, when they soon reduce to their normal weight of 8 or 9 pounds. The brood of young, numbering from 2 to 8, is born in the spring or early summer; they are forced to leave the burrow and to shift for themselves when a few months old. Woodchucks are playful creatures when young, but grow rapidly into slow-moving, heavy-bodied adults. The woodchuck, generally a bold and unsuspecting creature, has alert senses and, where much persecuted, may become extremely vigilant. When driven to bay, it can fight with considerable courage and effectiveness. Its chief natural enemies are foxes and bobcats, but the animal remains generally abundant in both cultivated regions and woodlands throughout its range.

See also MARMOT.

KARL F. KOOPMAN

**WOODCOCK**, wōd'kōk, a well-known American game bird (*Philohela minor*), belonging to the sandpiper family (Scolopacidae). The body is full and robust, the wings short and rounded the head and eyes very large, and the bill straight tapering from the stout base, grooved for nearly the entire length, and exceedingly sensitive at the end. The legs are very short for a snipe. The woodcock is 10 or 12 inches long and weighs from 7 to 9 ounces, the female being the larger bird. The colors are a soft harmonious blend of various shades of brown and gray, with black mottling above and with a nearly uniform pale brown coloring below.

**Habits.**—The woodcock seldom venture beyond the limits of the eastern half of the United States at any season, except to invade Ontario and other southern provinces of Canada. In winter it migrates to the South Atlantic and Gulf states, but mostly it breeds in the Central and Northern states. Migration northward begins very early, and many of the more hardy individuals reach the Middle Atlantic and New England states in early March before the frost has left the ground. At such times, and also in the late fall they secure their food, consisting of insects and their larvae and snails, by turning over faller leaves; but during summer and whenever the ground is sufficiently soft, they probe it with their long sensitive bills and extract with great skill the earthworms which constitute their chief food. Even when the bill is plunged deeply into the earth, the large eyes, placed very high and forward on the head, permit unobstructed vision in all directions.

Woodcocks frequent bogs and swampy places along alder-grown streams and hillside springs

Woodchuck (*Marmota monax*)

John H. Gerard from National Audubon Society







KARL H. MASLOWSKI, FROM NATIONAL AUDUBON SOCIETY

Woodcock (*Philohela minor*)

during summer; but in autumn they forsake these coverts for cornfields and undergrowth of low woods, the surest indication of their presence being their perforations in the soft earth. As the large size of the eye suggests, the woodcock is crepuscular and nocturnal. The period of its greatest activity is in the hours immediately succeeding sunset and preceding dawn, although, when the moon is full, it may be abroad throughout the night. During the day it remains hidden in deep bogs and thickets, rising only when frightened; then, springing perpendicularly above the bushes, it flies in an irregular course for a short distance and drops as suddenly to the ground.

In April or even earlier it builds a simple nest of leaves and grass in a dry, well-concealed spot in a bog and lays four buffy eggs spotted with dark brown and lilac. After incubation the fluffy brownish white chicks leave the nest at once, led away by the parent. The parent is very solicitous in the care of its young and not only feigns injury to entice an intruder from their vicinity but has been said to carry them, one by one, between its thighs to a place of safety.

The courtship flight of the male is curious and interesting. After a series of nasal *peents*, delivered with much apparent effort, he springs from the ground and mounts high in the air on whistling wings in a long circular flight. He then zigzags slowly earthward, each phase of the descent being accompanied by a series of clear and musical notes. This music is partly vocal in origin but in part is produced by the vibration of the air through the outer wing quills, which are stiff and narrow. The male bird then drops like a plummet to the exact spot from which he took wing. He is quite fearless when engaged in his courtship flights, which are repeated at short intervals and may be observed, even with the aid of a flashlight, without disturbing him. With the coming of hard frosts, most of the woodcocks leave for the South, and become concentrated in favorite bottoms along the lower Mississippi River area and other sections of the Gulf states.

The European woodcock (*Scolopax rusticola*) is similar to the American species, but is larger and is prominently barred below. It is found over a wide range from temperate Europe to

parts of Asia. Three additional but little-known, species of woodcocks are resident in the East Indies, in New Guinea and adjacent islands. The more remarkable of them is known only from the little island of Obi in the Moluccas.

DEAN AMADON,

Lamont Curator of Birds, The American Museum of Natural History, New York City.

**WOODEN, John** (1910– ), American basketball coach, who led the University of California at Los Angeles (UCLA) to unequalled dominance in collegiate competition. From 1964 to 1975 his teams won the NCAA championship 10 times, including a record seven straight titles and a streak of 88 wins (1970–1974). During that span the UCLA Bruins amassed 282 wins against only 15 losses. An astute tactician, Wooden emphasized offensive finesse, with balanced scoring, and tenacious defense.

John Robert Wooden was born in Martinsville, Ind., on Oct. 14, 1910. At Purdue University he was named to the All-America basketball team in 1930–1932. A successful high school and small-college coach in Kentucky and Indiana, Wooden was appointed head coach at UCLA in 1948. Under his tutelage the Bruins gradually became a national power. Some of his players, such as Lew Alcindor (Kareem Abdul-Jabbar), Bill Walton, and Gail Goodrich, became outstanding professionals.

Wooden retired in 1975 after winning his 10th national title. He was the first person voted into the Basketball Hall of Fame as both a player and a coach.

HARVEY FROMMER

Coauthor of "Basketball My Way"

**WOODFALL**, a family of English printers and journalists:

**HENRY WOODFALL:** d. 1769. He was the publisher of the *Public Advertiser*, master of the Stationers' Company in 1766, and author of the ballad *Darby and Joan*, printed in the *Gentleman's Magazine* of March 1735, for which Woodfall's employer, John Darby, and his wife were said to be the models.

**HENRY SAMPSON WOODFALL:** b. London, England, June 21, 1739; d. there, Dec. 12, 1805. Son of the preceding, he took over management of the *Public Advertiser* from his father in 1758. Among its contributors was Sir Philip Francis, reputedly the author, during 1768–1772, of the famous *Letters of Junius* (see JUNIUS, LETTERS OF), attacking public characters of the day. Woodfall, however, is on record as stating that he definitely knew that Francis "never wrote a line of Junius" and that he had no personal acquaintance with the author of the letters. After the Junius letter to George III had appeared in the *Advertiser*, Woodfall was prosecuted by the crown for libel in 1770, but the verdict was practically one of acquittal. He published the letters in book form in 1772 and profited largely by their sale. He sold the *Advertiser* in 1793, and two years later it ceased publication. In 1797 he served as master of the Stationers' Company.

**WILLIAM WOODFALL:** b. 1746; d. London, England, Aug. 1, 1803. The younger brother of Henry Sampson Woodfall, he worked at first on the *Public Advertiser*, was editor of the *London Packet* from 1772 to 1774, and edited the *Morning Chronicle* from 1774 to 1789. In 1789 he established a daily newspaper, the *Diary*, in

which he published, for the first time, reports of parliamentary debates the day after they had taken place; he was compelled to write the reports from memory, since it was forbidden to take down debates in the House. He was also noted as a keen and sometimes truculent drama critic.

**GEORGE WOODFALL:** b. 1767; d. London, England, Dec. 22, 1844. Son of Henry Sampson Woodfall, he was a partner in his father's business until 1793 when the *Advertiser* was sold. He then carried on the printing trade at another location and became noted as a typographer. Perhaps his most famous piece of work was the edition of *Junius* (3 vols., 1812), including letters not previously collected or published. He also maintained that Sir Philip Francis did not write the letters, and their authorship was not divulged by him even to his son, Henry Dick Woodfall, who carried on the printing business after the death of his father.

ROSAMOND MUELLER.

**WOODHULL, Victoria.** See CLAFLIN, VICTORIA WOODHULL.

**WOODIN,** wōōd'ən, **William Hartman**, American industrialist and cabinet officer: b. Berwick, Pa., May 27, 1868; d. New York, N.Y., May 3, 1934. He attended the School of Mines of Columbia University and then worked in his father's foundry at Berwick, becoming general superintendent in 1892 and president in 1899. In the latter year he joined the American Car & Foundry Company, which he served as president from 1916 to 1922. He was also chairman of the board of the American Locomotive Company. Although previously a Republican in politics, Woodin supported Franklin D. Roosevelt's presidential campaign in 1932 and became secretary of the treasury in 1933, at a period when the country was in the throes of a severe banking and financial crisis. The successful efforts he made to restore public confidence led to a breakdown in his health and compelled him to resign his office at the year's end. Music was his avocation. Among his compositions are *Raggedy Ann's Sunny Songs*, pieces for children published in 1930, and the *Franklin Delano Roosevelt March*, which was played at Roosevelt's inauguration.

**WOODLAND,** wōōd'lənd, city, California, seat of Yolo County, 18 miles northwest of Sacramento. The center of an agricultural region, it has a beet-sugar refinery, stockyards, feed mills, vegetable- and fruit-packing plants, rice and olive mills, and a plastics-manufacturing plant. Its Victorian buildings, in an excellent state of preservation, are of architectural and historical interest. Woodland Memorial Clinic Hospital is noted throughout northern California. Founded as Yolo City in 1855, the settlement was renamed Woodland because of the grove of oaks in which it stood. It was incorporated in 1871. Government by city manager and council was adopted in 1947. Population: 39,802.

RITCHIE D. THOMAS.

**WOODMEN OF THE WORLD**, a fraternal life insurance society in the western United States. It is a nonpolitical, nonsectarian organization with lodges, called camps, in the following states: California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Its home office is in Denver, Colo. Membership is open to

men, women, and children, to whom all regular forms of life insurance certificates are issued. Adult and junior certificates in force total over 37,000.

DAN H. MILLER.

**WOODMEN OF THE WORLD LIFE INSURANCE SOCIETY**, a nonprofit fraternal life insurance society founded in 1890 in Omaha, Nebr., where its home office is still situated. The organization has over 4,000 camps (men's lodges) and courts (women's lodges) in 45 states of the United States, and almost 1,000 youth groups (Boys of Woodcraft clubs, Sportsmen's clubs, and Girls of Woodcraft courts). Besides providing life insurance at cost, the society has a varied social, recreational, and civic service program, including special awards to students to encourage the study of American history and other awards for community service and the conservation of natural resources. One of the society's special activities is to mark historic sites and place monuments to distinguished Americans. Adult and junior membership is about 500,000.

**WOODMERE,** wōōd'mēr, unincorporated village, New York, in Nassau County, on Long Island, between Cedarhurst and Hewlett, in the Town of Hempstead. It is almost entirely residential; the majority of its gainfully employed residents commute to New York City. Woodmere is located on a bay of the Atlantic Ocean, and boating and fishing are favorite recreations. The village was originally called Brower's Point, after the Brower family, who were largely responsible for its settling. In 1868 the name was changed to Woodsburgh, in honor of Samuel Wood who purchased most of the property. The name Woodmere was adopted in 1875. Population: 15,578.

ELIZABETH W. THOMSON

**WOODPECKER,** wōōd'pēk-ər, a bird of the subfamily Picinae which is widely distributed in the forested regions of the world but lacking in Australia, Madagascar, and most of the islands of the Pacific Ocean. This subfamily consists of about 180 species and, together with its relatives the wrynecks (subfamily Jynaginae) and piculets (subfamily Picumninae), constitutes the family Picidae.

**Wrynecks and Piculets.**—The wrynecks and piculets are considered to be more primitive because they are less specialized for a life in the trees than the true woodpeckers. They differ from the latter in many respects, the most conspicuous being that the feathers of their tails are soft, their bills are much weaker, and, with one exception, they do not excavate their own nesting cavities. The wrynecks consist of only two species, one in Eurasia and the other in Africa, and are about six inches in size with a brown plumage speckled with white. Their curious name comes from their habit of contorting their necks at odd angles. See also WRYNECK.

The piculets are very small, varying from only three inches in size, or a little less, to about five. Most species are dull green, spotted with black in some cases. They inhabit subtropical or tropical regions and are best represented in the Americas, where there are 25 species ranging from the Antilles and Honduras south to northern Argentina; 3 species are Asiatic, and 1 is west African. They appear to be a very ancient bird group.

**True Woodpeckers.**—The true woodpeckers

(Picinae) are well characterized by their anatomy and mode of life. The texture of the tail is harsh, its feathers being stiffened by wirelike shafts. The bill is straight and very powerful; it is usually long and is always flattened laterally at the tip in the form of a chisel. The birds excavate their own nesting cavities by chiseling into a limb or the trunk of a tree, although one curious species, the ground woodpecker (*Geocolaptes olivaceus*) of South Africa, digs them into a bank in the earth. The tongue is very specialized for spearing or enmeshing their prey, which consists chiefly of insect grubs or ants. It is very long, extensible, provided with backward-pointing barbs at the tip, and coated in many species with a sticky substance. With it they probe deeply into narrow cavities in the wood or under the bark of trees or, in some species, in galleries in the ground frequented by ants. Only two of their toes face forward (a characteristic shared by the wrynecks and piculets); the fourth toe is directed backward or is missing. Their flight is undulating, and most woodpeckers climb vertically and upward, using the stiffened tail as a brace in climbing or when chiseling and hammering the trees.

The male does all or most of the excavating of the nest and shares with the female the incubation and rearing of the young. The eggs are pure white, the clutch varying from 6 to 9 eggs, which in most species hatch between 12 and 14 days.

**Genera.**—The best-known woodpeckers are those of the genus *Dendrocopos*, which numbers 35 species. These species, which inhabit the Old and the New World, have a pied black and white plumage, the male usually having some red patches on the head. They vary in size from about 4½ to 10 inches. The familiar hairy woodpecker (*D. villosus*) and its small relative, the downy woodpecker (*D. pubescens*), of North America are typical and are replaced by very similar species in Eurasia.

The flickers (genus *Colaptes*), which consist of six species restricted to the Americas, are much more colorful than the pied woodpeckers. Their plumage consists of various combinations of soft grays and browns, boldly banded or spotted with black; red is present also, and the rump is snow white. In addition, the wings and tail are golden in the yellow-shafted flicker (*C. auratus*) of eastern North America and red in its close relative (*C. cafer*) of western North America. The flickers are "aberrant" in the sense that they spend much of their time on the ground, digging for ants. Another very handsome American species, not closely related to the flickers however, is the red-headed woodpecker (*Melanerpes erythrocephalus*). Its whole head down to the upper breast is bright crimson, and the rest of its plumage is a bold combination of blue-black and snow white.

The green woodpeckers of the Old World, of the genus *Picus*, are another very distinct group, consisting of 15 species. The best known, the green woodpecker of Europe (*P. viridis*), is green above with a golden rump and, like the flickers, feeds much on the ground. The sapsuckers (*Sphyrapicus*) of North America are a small but also interesting group. The two species of this genus drill rows of shallow holes through the bark of trees and, as their name indicates, drink the exuding sap and also eat the insects that are attracted to it.

The most striking, and one of the largest, of all woodpeckers is the ivorybill (*Campephilus prin-*



Allan D. Cruickshank from National Audubon Society

Downy Woodpecker (*Dendrocopos pubescens*)

*cipalis*), which measures 20 inches and has a very bold black, white, and red plumage and an enormous yellow-white bill. A few pairs still live in western Cuba, but it is feared that it is now extinct in the United States, where it inhabited the primeval forest of the Southeast. Two related species inhabit Mexico and southern South America.

CHARLES VAURIE,  
Associate Curator, Department of Ornithology,  
The American Museum of Natural History,  
New York City.

**WOODRING**, wōd'ring, **Harry Hines**, American banker and political leader; b. Elk City, Kans., May 31, 1890; d. Topeka, Sept. 9, 1967. After 23 years in the banking business in Neodesha, Kans., interrupted by service in the U.S. Army Tank Corps in World War I, he sold his interests in 1929 and entered politics as a Democrat.

As governor, from 1931 to 1933, of usually Republican Kansas, Woodring opposed capital punishment, supported economics in government, and endeavored to reduce public utility rates. Woodring was unsuccessful in his bid for reelection in 1932, but as an early backer of Franklin D. Roosevelt's presidential candidacy, he was appointed assistant secretary of war by Roosevelt on April 6, 1933. After the death of Secretary of War George Henry Dern, Woodring succeeded to the cabinet post on Sept. 25, 1936. As secretary of war, he sought to strengthen the Army, particularly its air arm, and strongly urged American preparedness, but was opposed to involvement in distant conflicts. This position of non-intervention brought him into disagreement with certain policies of the Roosevelt administration after World War II started, and on June 20, 1940, he resigned from the cabinet. He subsequently engaged in politics in Kansas, running unsuccess-

fully for governor in 1946 and for the Democratic nomination for governor in 1956.

G. W. SCHULZ.

**WOODRUFF**, wōd'ruf, **Wilford**, American Mormon leader: b. Farmington (now Avon), Conn., March 1, 1807; d. San Francisco, Calif., Sept. 2, 1898. He adopted the Mormon faith in 1833 and soon was high in the church's councils, being made an apostle in 1839. Besides wide missionary travels in the United States, he went on two highly successful missions to England in the early 1840's. Woodruff was one of the advance party that first reached the valley of the Great Salt Lake in 1847 and was a leading member of the community in Utah from that time on. In 1880 he became president of the quorum of the Twelve Apostles of the Mormon Church, its second highest office, and in 1889 succeeded to the church presidency. In this capacity, in 1890, he proclaimed the end of plural marriage, which he himself had practiced. His journals, which have been published, are an important part of the early record of Mormonism.

**WOODRUFF**, wōd'ruf, a perennial plant, *Asperula odorata*, of the madder family (Rubiaceae), native to Eurasia and northern Africa, but naturalized elsewhere. Woodruff is pleasantly hay scented when it is dried. Because of this, it has been used to stuff pillows, to scent linens, and to flavor wine, and bundles of woodruff have been hung in homes and churches. In folk medicine, woodruff-leaf tea is prescribed for colds. Tea made from the dried flowers is a pleasant drink. Woodruff has slender, branched underground runners and four-angled stems that grow to 18 inches tall. Its elongate, pointed leaves have minute, forward-pointing prickles on the margin and are borne in widely separated whorls. The funnel-shaped flowers are white and fragrant and are grouped in long-stalked clusters. The small fruits are covered with hooked prickles.

JOHN W. THIERET.

**WOODS**, wōdz, **Robert Archey**, American settlement worker: b. Pittsburgh, Pa., Dec. 9, 1865; d. Boston, Mass., Feb. 18, 1925. He graduated from Amherst College in 1886 and then attended Andover Theological Seminary. After a year in England studying reform movements, he was placed in charge (1891) of Andover House (renamed South End House in 1895), the first settlement house in Boston, which he continued to direct for the rest of his life. Woods' early books on depressed areas in Boston, *The City Wilderness* (1898) and *Americans in Process* (1902), were the first studies of this kind and scope to be made in the United States. In 1911 he organized the National Federation of Settlements, serving as secretary until 1923 and as president thereafter. His basic concept that the neighborhood is the fundamental social unit is expounded in essays collected in *Neighborhood in Nation-Building* (1923). He also wrote an important history of settlement work in the United States, *The Settlement Horizon* (1922).

**WOODS**, **William Burnham**, American lawyer and justice of the Supreme Court: b. Newark, Ohio, Aug. 3, 1824; d. Washington, D.C., May 14, 1887. After graduating from Yale University in 1846, he was admitted to the Ohio bar in 1847 and from 1857 was a leader of the Democratic Party in the Ohio legislature. When the Civil War

began, he first opposed the policies of President Abraham Lincoln, but early in 1862 he joined the Union Army as a lieutenant colonel in the 76th Ohio Infantry, attaining the rank of brigadier general before his discharge in 1866. He took part in many of the major battles of the war, including Shiloh, Chickasaw, Arkansas Post, and Vicksburg, and accompanied Gen. William T. Sherman in his march to the sea. After the war, Woods identified himself with the Republicans and went to Alabama to aid in reconstruction. In 1869 he was appointed a United States circuit judge for Georgia and the neighboring states, and in 1880 he was named an associate justice of the United States Supreme Court by President Rutherford B. Hayes. He was noted for his ability to deal with complicated issues, among them the civil rights of the Negroes under the new amendments to the Constitution.

**WOODS HOLE**, village, Massachusetts, in the town of Falmouth (q.v.), in Barnstable County, situated at the southwest tip of Cape Cod, 16 miles southeast of New Bedford. A summer resort, Woods Hole has a good harbor, and boats go from here to Martha's Vineyard and Nantucket. The village is noted for the Woods Hole Oceanographic Institution, founded in 1930 and endowed by the Rockefeller Foundation. The institution has a permanent staff of scientists and maintains the research ship *Atlantis*. The Marine Biological Laboratory, which offers summer courses in marine biology, and a branch of the United States Bureau of Fisheries, which maintains laboratories, an aquarium, and fish hatcheries, are also located here.

**WOODSON TERRACE**, wōd'son, city, Missouri, in northwestern St. Louis County, about nine miles from the city limits of St. Louis, adjoining the St. Louis Municipal Airport. It is primarily a residential community, with an aircraft company on its northern outskirts. Woodson Terrace was incorporated as a village in 1946 and as a city in 1954. It is governed by a mayor and board of aldermen. Between World War II and 1960 the population increased by almost 900 percent. Population: 4,362.

LORETTA HEINZELMAN.

**WOODSTOCK**, wōd'stök, city, Illinois, McHenry County seat, 32 miles west of Waukegan. Situated in a dairy and farm area, it is the county's merchandising center and manufactures typewriters, beds, and metal products. Founded in 1844, the city was originally called Centerville because of its geographical position in McHenry County. In February 1845 the present name was adopted since a number of the residents came from Woodstock, Vt. Woodstock is built around a square at the head of which stands the courthouse. In the center of the square is a monument honoring the soldiers of the Civil War. The city was incorporated in 1852 and has the city manager form of government. Population: 14,353.

EDITH KNILANS.

**WOODSTOCK**, town, New Brunswick, Canada, seat of Carleton County, on the west bank of the St. John River, about 45 miles west-northwest of Fredericton. It is on the Trans-Canada Highway, has railway freight and express service, and, being near the Maine border, is one of the principal places of entry into the province from the United

States. Woodstock was founded by families loyal to Britain at the end of the American War of Independence. It is situated in a prosperous dairying, mining, and farming region, the growing of potatoes being important. The vocational school here was the first in the province to offer courses in agriculture. Island Park is a picnic and recreational ground. Population: 4,649.

ALFRED G. BAILEY.

**WOODSTOCK**, city, Ontario, Canada, Oxford County seat, 80 miles west-southwest of Toronto, on the Thames River. Public schools include the modernly equipped Collegiate Institute; the Redemptorist Fathers' College also is here. The courthouse, occupying a commanding position, is noted for its architectural beauty. The city's chief industries are furniture and other wood products, stoves, garden implements, wire fences, pianos, organs, dairy products, and textiles. Pop. 26,603.

D. F. PUTNAM.

**WOODSTOCK**, a novel by Sir Walter Scott (q.v.), published in 1826. Though included in the Waverley series (see *WAVERLEY NOVELS*, THE), and originally conceived as a historical re-creation of life in Scotland, *Woodstock* is laid in England during the Cromwellian period. The novel covers the years 1651 to 1660, but the action focuses on the earlier part of the period, and its central concern is Charles II's escape from England disguised as a peasant. The action is a swift succession of dramatic episodes which, in keeping with Scott's aim as a historian, presents the reader not with actual facts but with the feeling of having lived through the early days of the Commonwealth. Scott is interested in the human spectacle, and thus he creates incidents relevant to this end. For example, we experience the emotions of Oliver Cromwell as he stands in Windsor Castle before the Van Dyck portrait of the king he has beheaded; or we relive with the protector his growing apprehension as Albert Lee upbraids him with the text: "Had Zimri peace who slew his master?"

Scott has the genius to make a place speak and tell its story. Perhaps from long association with the border country and its traditions he could invest a spot—in this novel Woodstock, a royal lodge—with a quality that makes the place seem right for the persons and customs from the past that cluster about it. As a result Scott's characters are not puppets: they are historically significant insofar as they are dramatically significant. Cromwell emerges, not as a documented figure, but as the human being he might have been: mystical, capable of self-deception, magnanimous, and great of spirit. The same is true of several other figures: Roger Wildrake, the Cavalier; Everard, the moderate who accepted Cromwell instead of anarchy; Desborough, the adventurer; Bletson, the agnostic; and Harrison, the opportunist.

DONALD B. CLARK,  
Professor of English,  
University of Missouri.

**WOODSTOCK COLLEGE**, a Roman Catholic theological institution in New York City. It was opened in Woodstock, Md., by the Jesuits for their own ecclesiastical students in 1869, when the papal charter for the faculties of philosophy and theology, originally granted to Georgetown University in 1833, was officially transferred to Woodstock. Since 1952, Woodstock has func-

tioned chiefly as a college of sacred theology. The regular four-year course leads to the degrees of bachelor of sacred theology or licentiate in sacred theology; the curriculum for the degree of doctor of sacred theology normally requires two further years. In 1969, Woodstock moved from rural Maryland to New York City. Enrollment is 250.

TERRENCE TOLAND, S.J.

**WOODSWORTH**, wōdʒ'wūth, James Shaver, Canadian humanitarian and political leader: b. Islington, Ontario, Canada, July 29, 1874; d. Vancouver, March 21, 1942. The son of a well-known Methodist home mission leader, James Woodsworth, he was educated in Canada and England and ordained a Methodist minister in 1900. His work in Canada took him to the western prairies, where he observed the problems of the New Canadians (recent immigrants from continental Europe); and he wrote several books, such as *The Strangers Within Our Gates* (1909), on this theme. Woodsworth's distrust of church dogma and his advanced social views, added to the pacifist stand that he took when World War I began, brought a break with the church in 1918. For a time he worked as a longshoreman in Vancouver, where he became deeply involved in labor organization. When a lecture tour took him to Winnipeg in May 1919, he was drawn into the general strike that paralyzed the life of the city, and he edited the strike bulletin until he was arrested on a charge of seditious libel, a charge which was later dropped.

Woodsworth won a seat as a Labour member of Parliament in 1921, representing Winnipeg North Centre, and he held this constituency until his death. In Parliament he worked tirelessly for a better social order: a notable example was in 1926, when he skillfully took advantage of a precarious government majority to win support for old-age pension legislation. As a socialist, he stood almost alone, but he won the esteem of the House for his conviction. He was a leading founder of the Co-operative Commonwealth Federation (q.v.) in 1932 and was chosen its first leader, but his relationship with the party was disrupted in 1939 when he left it to take a pacifist stand against involvement in World War II. He continued to hold his seat in Parliament until he suffered a stroke in 1941 and died shortly afterward.

JOHN H. ARCHER,  
Legislative Librarian, Province of Saskatchewan Legislative library.

**WOODVILLE**, wōd'vīl or WYDEVILLE, wīd'vīl, the name of an influential English landowning family, which was prominent in the 15th century. Some leading members of the Woodville family included:

**RICHARD WOODVILLE, 1ST EARL RIVERS:** d. Kenilworth, England, Aug. 12, 1469. He was the son of Richard Woodville, of the Mote, Maidstone, Kent, and Grafton, Northamptonshire. Like his father, with whom he is sometimes confused, he was a military commander in English-occupied areas of France; later he fought in the Wars of the Roses. In 1436 he secretly married Jacquetta of Luxembourg, widow of John of Lancaster, duke of Bedford, a son of Henry IV; the lady was fined £1,000 for marrying without royal permission. Woodville was created Baron Rivers in 1448 and Earl Rivers in 1466. He took part in



the suppression of Jack Cade's rebellion (1450) and in 1459 was appointed a commander at Sandwich, where he and his son Anthony were captured by the earl of Warwick's forces from France early in 1460. Rivers escaped, fought on the side of Henry VI at Towton (March 29, 1461), and accompanied the king on his flight to Newcastle. Later the same year, however, he switched his allegiance to Edward IV, who secretly married his daughter Elizabeth on May 1, 1464. The Woodville influence became dominant at court, arousing the jealousy of the older noble families. After Edward's defeat at Edgecot, near Banbury, Rivers and his son John were captured at Chepstow and executed.

**ELIZABETH WOODVILLE** (1437?-1492). See **ELIZABETH**, consort of Edward IV of England.

**ANTHONY WOODVILLE, 2D EARL RIVERS:** b. ?1442; d. Pontefract, England, June 25, 1483. Oldest son of Richard, he married Elizabeth, Baroness Scales in her own right, and was recognized as Lord Scales. In 1469, on his father's execution, he became Earl Rivers. He accompanied Edward IV on his flight to the Netherlands in 1470, returned to England with Edward in 1471, and in November 1473 became tutor to the young Prince Edward, of whom he had possession on Edward IV's death. Seized by Richard, duke of Gloucester (later Richard III), at Northampton on April 30, 1483, he was taken to Pontefract and executed. Woodville was a patron of William Caxton (q.v.), the printer, and translated from the French the first book that Caxton printed in England. He was also the author of various poems, now lost except for a touching lament presumably written just before his death.

**LIONEL WOODVILLE:** b. ?1446; d. 1484. Third son of Richard, he studied at Oxford and became bishop of Salisbury in 1482. He took a leading part in the rebellion against Richard III organized by the 2d duke of Buckingham, who had married Woodville's sister Catherine. When the rebellion failed, Woodville fled to Henry of Richmond (later Henry VII) in Brittany, where he probably died.

RICHARD E. WEBB,  
*Director, Reference and Library Division, British Information Services, New York City.*

**WOODWARD**, wōd'wārd, **Calvin Milton**, American educator: b. near Fitchburg, Mass., Aug. 25, 1837; d. St. Louis, Mo., Jan. 12, 1914. Graduated from Harvard College in 1860, he was a high school principal in Newburyport, Mass., and served for a year as a captain of volunteers in the Civil War. In 1865 he was called to Washington University, in St. Louis, where he was dean of the polytechnic school (1870-1896) and of the school of engineering and architecture (1901-1910). In 1880 he pioneered in a new educational field by founding the St. Louis Manual Training School under the auspices of the university. As school director he inaugurated the plan of offering manual training courses, together with general education, to boys from 14 years of age, with the aim of discovering individual innate capacities. The experiment was immediately popular and spread to other cities. Woodward filled various other positions in the educational field with distinction, including the presidency of the University of Missouri (1894-1897). His publications included *The Manual Training School* (1887), *Manual Training in Education* (1890), and *Rational and Applied Mechanics* (1912).

**WOODWARD**, city, Oklahoma, seat of Woodward County, located about 85 miles west of Enid on the North Canadian River. Lying in a fertile farming and ranching area, the city is a market and processing center for wheat and cattle, with oil and gas fields in the vicinity. A United States agricultural experiment station is located in the city; Boiling Springs State Park and Alabaster Caverns State Park are nearby. The city was founded at noon on Sept. 16, 1893, with the opening of the Cherokee Strip to white settlement, and was named for Brinton W. Woodward, director of the Atchison, Topeka and Santa Fe Railway. It is governed by a manager and three-man commission. Pop. 13,610.

ROBERT E. LEE.

**WOODWAXEN** or **WOODWAXEN**, wōd'wāk-sən (also known as **DYER'S GREENWEED**), an upright or sprawling shrub, *Genista tinctoria*, of the legume family (Leguminosae), native to Eurasia. It is sometimes grown as an ornamental shrub and has become naturalized in parts of the United States. At one time, in England, a green dye was made by mixing woad (a blue dye) with the yellow dye obtained from woodwaxen. A tea made from woodwaxen has been used in folk medicine as a purgative and diuretic. Woodwaxen grows from a few inches to 3 feet tall and has lanceolate, stalkless leaves up to 1½ inches long, which may have a fringe of small hairs on the margin; yellow, pealike flowers borne in clusters that terminate the branches; and small flat pods.

JOHN W. THIERET.

**WOODWORKING**, wōd'wŭrk-īng, in the most general sense, any activity involving the working or shaping of objects of wood. Originally the term referred only to making interior fittings of wood, such as moldings and stairways, but now it is generally used to include carpentry, joinery, cabinetmaking, millworking, and furniture manufacturing. Closely allied are such occupational areas as upholstering, furniture finishing, and painting.

#### HISTORICAL DEVELOPMENT

**Prehistoric and Primitive Times.**—The history of woodworking begins with early man. Possibly the first woodworking tool was fire, which prehistoric man undoubtedly used to hollow out logs; these were then scraped with shells or rocks to remove the charred wood, and were fashioned into rude canoes. Other primitive boats consisted of logs fastened together to make rafts. Later these were developed into sturdy sea-going vessels, which were constructed with good proportion and sound workmanship.

After the savage era, man continued to use wood, combining it with newer discoveries, and the original materials of stone, bone, ivory, and wood were used with bronze and iron. Primitive looms were made from branches of trees. Bows and arrow shafts were of wood. The American Indians undoubtedly used wooden utensils and weapons more than 10,000 years ago, but the wood disintegrated, and traces of the exact nature of the items have vanished. Aborigines of Australia and New Zealand had no bows or arrows, and their boats were of the crudest character, but they used wood for weapons such as the boomerang, blowpipe, and bola. The sling and throwing stick were unknown. The spear, which is a development of the knife point, and the club,

which is a long hammer, were the only natural and universal weapons of man.

Builders of the Neolithic lake dwellings in Switzerland, France, and Italy cultivated land crudely, and cereals were in cultivation before the Bronze Age. This was possible because primitive man tilled the land with wooden tools which had the shape of gouges and were used as spades. The dirt clods were beaten and broken by pieces of wood also. The hoe was an oyster or tortoise shell fixed on the end of a stick.

Remnants of lake dwellings preserved in peat moss deposits at the bottom of Lake Geneva reveal ancient wooden piles on which the huts were set. Implements of wood have also been found there. All of these would have disintegrated if left in open water. Dwellers in caves ground their cereals with stones in wooden troughs. The potter's wheel, known in China from very early times, is shown in wall paintings dating 19 or 20 centuries before Christ. All this points to a remarkable achievement in woodworking and its bearing on the development of the crafts.

In the centuries that followed, woodworking was developed to a high degree in all the centers of civilization, from the Far East and India to the Mediterranean basin. Ships and land vehicles were made basically of this material, and weapons, tools, domestic furniture, and ornaments bear witness to the skill of the craftsmen.

**Medieval Europe.**—In medieval times the misery of the peasants was heightened by the fact that wooden items were extremely valuable. Interesting to note is that beds on which they brought their dead to the churches were confiscated by the clergy. The forests were valuable, and the supply of wood to which the peasants were entitled was strictly limited. Wood was used in huts, and in Chaucer's time in England one reads of decrepit hovels with rotten beams and half-ruined walls. At first forests were so dense that workers were impressed to clear them. Later, as populations increased and wood was in greater demand, persons cutting trees illegally were cruelly prosecuted. Utilitarian products of medieval woodworking included such things as carts, plows, barrows, cider presses, kneading troughs, baskets, chests, spades, axes, forks, chairs, tables, and beds. There was also much fine use of wood for artistic purposes.

**Guilds and Craftsmen.**—The carpenter, according to J. Malet Lambert in *Two Thousand Years of Guild Life* (1891), was originally one who made the "carpent" or heavy covered carriage or cart. From this the meaning of the term was extended to include any craftsman who made heavy woodwork, such as timbers of houses and roofs. The joiner worked on doors and smaller kinds of woodwork. A third class was the shipwright.

The hereditary smith or carpenter existed long before their crafts were organized into guilds, which presupposed a considerable development of town and industrial life. According to some authorities, guilds were founded in England as early as 856 A.D. From the 12th century onward, the craftsmen of a trade, when they became numerous, formed themselves into a fraternity along the same lines as the older guild system, with the privilege of monopoly and the power of enforcing regulations. Guilds for woodworkers thrived in the Middle Ages; in England, the Fraternity of Carpenters, formed around 1308, was a powerful one. From the end of the 13th century, apprentices there had been bound as pupils to

skilled workmen for a fixed period of time, which by 1647 was eight years and later was shortened to seven.

**Colonial America.**—Wood was the only basic material available to the American colonists at first; from it they had to make all the necessary everyday utensils and tools. Until metal was processed, items such as bowls, plates, buckets, tools, paddles, ladles, and drinking mugs were fashioned in simple, useful design from wood by woodworkers. Early furniture was of sturdy wooden construction. Even clocks had many moving parts made from wood.

As colonial society became more sophisticated, craftsmanship progressed from strictly utilitarian concepts to a concern for beauty of line and attractiveness of design. In the era prior to 1750 the Colonial style of design emerged; from 1750 to 1775, the Pre-Revolutionary. Fine furniture was imported from England, and the great craftsman Thomas Chippendale strongly influenced American design. The Post-Revolutionary period after 1800 was influenced by such great woodworkers as George Hepplewhite and Thomas Sheraton, with some French Empire semblance. The first American furniture designer and woodworker of note was a Scotsman named Duncan Phyfe, who lived and had his factory in New York City in the early part of the 19th century. The Duncan Phyfe designs have balance, structural soundness, and economy of construction.

**Modern Woodworking Concepts.**—The major contribution to furniture making in the 19th century was the development of woodworking machinery and the introduction of machine-made furniture. This accounts for the enormous quantity of furniture manufactured at relatively low cost.

Woodworkers of the 20th century developed "modern" design. This includes designing pieces to fit their purposes, that is, functionalism; and avoidance of excess bulk of line and the use of minimum materials. Functionalism plus beauty is the essence of good modern design. The trend in woodworking today is toward revival of the English Regency, German Biedermeier, and French Directoire styles, while the Danish, Oriental, and International Modern styles also occupy places of importance. The traditional styles take on a new look through a blending of the best from each period.

#### MAJOR FOREST REGIONS

**United States.**—Lumber used in woodworking depends upon sources and availability. There are six commercial forests in the United States (excepting Alaska and Hawaii), from which timber is harvested and lumber is processed.

**Pacific or West Coast Forest.**—This area extends along the moist western slopes of Washington, Oregon, and northern California. The lumber obtained in Washington and Oregon is mostly Douglas fir (*Pseudotsuga taxifolia*); western hemlock (*Tsuga heterophylla*), western red cedar (*Juniperus scopulorum*), and Sitka spruce (*Picea sitchensis*) are also found. In northern California the characteristic wood comes from the redwood trees (*Sequoia sempervirens*), which are among the world's largest. The West Coast Forest comprises well over 28 million acres and represents more than 550 billion board feet of timber. Less than 4 billion board feet are in hardwoods.

**Western Forest.**—This forest includes portions of the 12 Western states covering about 35 percent of the continental United States. Nearly

100 million acres are considered commercial forest lands, from which are obtained 500 billion board feet of softwoods. These are chiefly western white pine (*Pinus monticola*), sugar pines, and some hardwoods.

**Northern Forest.**—Situated along the northern Great Lakes and in the northeastern part of the United States, this commercial forest section comprises more than 132 million acres which contain more than 62 billion board feet of softwoods and over 108 billion feet of hardwoods. The chief species are white pine (*Pinus strobus*), red spruce (*Picea rubra*), eastern hemlock (*Tsuga canadensis*), and other conifers, as well as hardwoods such as red oak (*Quercus rubra*), and white ash (*Fraxinus americana*).

**Central Hardwood Forest.**—Mostly hardwoods, covering over 47 million acres, grow in this forest area through the central eastern section of the United States. The yield is 46 billion board feet of hardwoods, including black walnut (*Juglans nigra*) and white oak (*Quercus alba*). Nearly 3 billion board feet of softwoods are also included. These are poplar (*Populus deltoides*) and sweet or red gum (*Liquidambar styraciflua*).

**Southern Forest.**—This forest stretches from Virginia through eastern Texas, and from Oklahoma to the Gulf of Mexico. There are over 183 million acres which produce nearly 194 billion board feet of hardwoods and softwoods. Growing here are black walnut (*Juglans nigra*), sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), bald cypress (*Taxodium distichum*), Georgia pine (*Pinus palustris*), poplar (*Populus deltoides*), and shortleaf pine (*Pinus echinata*).

**Tropical Forest.**—This forest grows in a very small area of the tips of southern Florida and Texas. Palm trees and some ebony trees are found here.

**Other Countries.**—In many other areas of the world fine forests yield many beautiful and exotic woods. These include African mahogany (*Khaya ivorensis*), and the New World mahoganies (*Swietenia mahagoni*), which come from the West Indies, Mexico, Central America, Colombia, Venezuela, and the upper Amazonian region. Both African and Central American mahoganies are used by the woodworker in making exquisite furniture. There are numerous other foreign mahoganies, but they are not extensively used by the woodworker or cabinetmaker because of the cost.

Philippine mahoganies originate in the Philippine Islands and belong to the plant family Dipterocarpaceae. These woods are varied in color and texture, but they are in no way, botanically or otherwise, related to the true or classical mahoganies. They are technically referred to as red or white lauans and are of a much coarser texture than the true mahoganies. Their grain in the form of quartered, sliced, and rotary cuts produces a lumber which is very pleasing for furniture, cabinetwork and millwork, and interior wall paneling. Other precious, rare, and expensive woods are often cut and sliced for veneering, to use on panels, marquetry work, and inlaying.

See also **FORESTRY—Forests of the United States (Forest Regions) and Forests of the World; TROPICAL FORESTS—Tropical Forest Products.**

#### HAND-TOOL PROCESSES AND HAND TOOLS

A woodcraftsman must be an artist in working with hand tools. In making anything from wood certain basic hand-tool processes must be performed well. Some of these processes and the

hand tools required are discussed in the following paragraphs.

The evolution of the hand tool is shown in Fig. 1. Illustrated are several old woodworking tools partly made of wood, with their present-day counterparts made of metal. This transition has occurred during the past century.

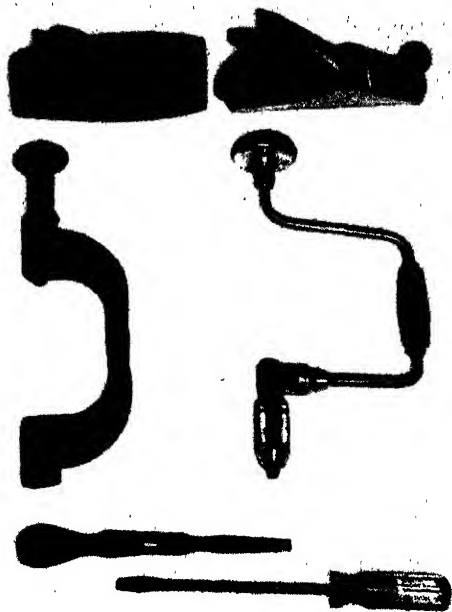


Fig. 1. Colonial period plane, brace, and screwdriver compared with modern counterparts.

**Measuring and Laying Out Lumber.**—This process involves laying out lengths, widths, thicknesses, lines, and angles. Practically all measuring tools used in woodworking have a scale divided into inches, half inches, quarters, eighths, and sixteenths. The tools more commonly used for measuring and laying out are the 1- or 2-foot steel or wooden rule, steel square, try square, zigzag rule, flexible steel rule or tape, T bevel, marking gage, and marking knife.

**Sawing Across or with the Grain (Fiber) of Wood.**—After the lumber or boards have been accurately measured and marked, they must be cut. The hand process requires the use of the steel-bladed handsaw. The more common woodworkers' saws for this purpose are the crosscut saw, rip saw, and the backsaw or cabinet saw. The number of points per inch makes the coarseness or fineness of a saw. There is always one more point per inch than there are teeth on the saw blade. For instance, a saw with eight points per inch will have seven teeth per inch. A coarse saw is better for doing fast work and for cutting green (undried) lumber. A fine one does smoother, more accurate cutting on seasoned (dry) wood. The crosscut saw is used to cut across the grain of the wood, and the rip saw is used for ripping or cutting with the grain. A saw cut is known as the kerf.

**Planing Lumber.**—Planing boards by hand often involves the process of squaring stock. This

is a basic procedure in which there are definite steps for planing the surfaces, edges, and ends of each board. The board has been squared when the surfaces are parallel to each other and when the edges and ends are 90 degrees to the surfaces and to each other. The sequence of steps for squaring a board are (1) the face or first surface, (2) the first edge, (3) the first end, (4) the opposite end, (5) the opposite edge, and (6) the last face or surface. The tools used in planing and/or squaring lumber are the jack plane, try square, framing square, marking gage, rule, crosscut saw, rip saw, and backsaw. Some of the more common planes used by the woodworker are the jack, smoothing, jointer, block, and rabbit planes.

**Shaping Chamfers and Bevels.**—A chamfer is a means of decorating an edge. A bevel may be either an edge treatment or a way to fit two boards together at an angle. The chamfer is usually planed to a 45-degree angle, while the bevel may be at any angle. Tools generally used for making either of these forms are a jack plane or a block plane. A sliding T bevel tests the angles.

**Laying Out Irregular Pieces and Curves.**—Woodworking is concerned with laying out, cutting, and forming (shaping) irregular cuts and curves on boards. This includes laying out a hexagon, an octagon, and an ellipse, and irregular markings for cutting and forming. Tools needed for laying out are dividers, trammel points, rule, and french curve. Cutting and forming tools consist of coping and turning saws, spokeshave, drawknife, wood or cabinet files, and surface- and edge-forming tools.

**Cutting and Trimming with a Chisel.**—Accurate cutting, fitting, shaping, and surface decorating are done with sharp woodworking chisels. Various types of these tools are used for horizontal, vertical, and curved chiseling, as well as for grooving with gouges. Wood chisels are generally classified as socket and tang chisels. Gouges are chisels used for grooving, shaping edges, and model making. Flat wood chisels and gouges have beveled cutting edges. Often a wooden or fiber mallet is used to give added driving pressure.

**Smoothing with a Scraper.**—Frequently surfaces and edges of a board must be scraped, particularly if the grain is burly or knotty. Hand scrapers are either straightedged or curved (swan neck). Straightedged or swan neck scraper blades are usually used by hand. The straightedged blade may also be fastened in a specially built holder for pushing or pulling. These are known as cabinet, pull, or box scrapers.

**Boring and Drilling Holes.**—Holes are bored or drilled in wood for screws, bolts, dowels, inside sawing, and ornamentation. Types of bits used for boring or drilling include the auger, twist drill, iron drill, gimlet, expansive bit, Forstner bit, straight-shank drill, and automatic drill. Tools for holding bits are a brace, hand drill, and automatic drill. A depth gage is used to control depth of drilling.

**Fastening with Screws.**—Screws are used to fasten boards and assemble woodworking projects. An advantage in using them is that a project can easily be taken apart and reassembled. The three most common types of screws for joining wood are the round-head, flat-head, and oval-head screws. Wood screws have single slotted heads, or Phillips-heads (cross slots). Tools used in driving screws are the screwdriver which will fit the

top of the screw, and bits for boring or drilling holes. A countersink bit is often used to recess the head of flat-head and oval-head screws.

**Driving and Pulling Nails.**—Nails are often used in assembling wooden projects and for carpentry construction, but they are used very sparingly in furniture building. The kinds most frequently used in woodworking are the box, common, finishing, brad, and casing nails. The size of nails is usually indicated by the term "penny" or its abbreviation "d." It is believed that these terms are derived from the weight of 1,000 nails; 1,000 10-penny nails weigh 10 pounds. Claw hammers with heads of different weights and nail sets of various sizes are the only essential tools.

**Gluing and Clamping.**—Boards are glued together edge-to-edge to make larger surfaces, or face-to-face to increase thickness. When they are properly made and the glue is prepared and applied correctly, glued joints are as strong as the wood, and in most cases, stronger. The classifications of glues used in woodworking are animal, casein, plastic resin, polyvinyl resin, resorcinol resin, and fish glues. Minor types include blood albumen, starch, all-purpose cements, and adhesives. Three types of clamps commonly used are the cabinet or bar clamp, hand-screw clamp, and C clamp.

**Preparing for Finishing.**—Furniture and cabinetwork should be thoroughly smoothed before a finish is applied. Furniture should have all traces of electric planer or mill marks removed by scraping and sanding. Cabinetwork and interior wood trim often retain mill marks, but should be thoroughly sanded. There are three natural abrasive materials used on wood. These are available as sandpaper, garnet paper, and emery cloth. The grit classifications range from extra fine to extra coarse.

#### POWER-TOOL PROCESSES AND MACHINE TOOLS

Stationary machine tools used in woodworking are classified as industrial (Fig. 2), heavy, and

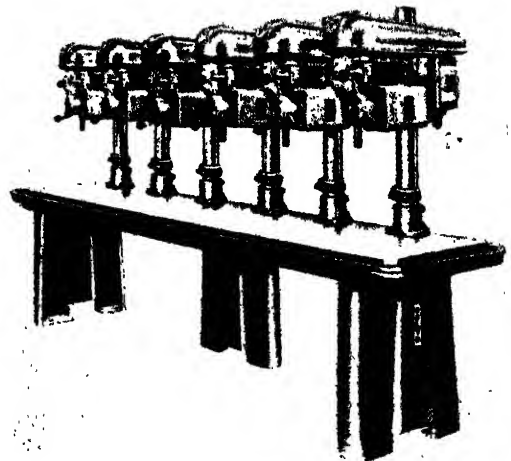


Fig. 2. A Delta multiple-spindle industrial drill press setup. This unit must be anchored.

lightweight (Fig. 3). The first two, must be leveled and fastened securely to suitable

footings. Lightweight machine tools are used where it is necessary to move them frequently, as in school industrial-arts laboratories, vocational industrial shops, in home and other building construction by contractors, and by the home craftsman.



Fig. 3. Operating a Delta lightweight, moveable 10-inch circular school-type saw.

For industrial and school use, woodworking machines are of the unit type, such as circular saws, planers, and jointers, rather than of the multipurpose type used by home craftsmen. The home craftsman or hobbyist often prefers a machine on which he can saw, plane, drill or bore holes, and sometimes sand. See Fig. 4.

Fig. 4. This Deltashop home craftsman all-purpose machine can be used for a variety of projects.



Portable electric power tools (Fig. 5) are commonly used by builders, schools, and the home craftsman. The most satisfactory portable power tools use available electric power in industry, schools, and homes. The home craftsman also has available to him power tools which obtain their electric power from the batteries of automobiles or from power packs which can be carried. The power-tool processes described in the following paragraphs are the more common ones used in woodworking.



Fig. 5. A Porter-Cable portable electric orbital sander.

**Sawing with the Circular Portable Electric Handsaw.**—The circular or table saw can do many complex operations, such as ripping, cross-cutting, dadoing, and shaping. Blades and cutters are available for many processes. This machine has some limitations because it is portable and is manipulated by hand; but fitted with proper blades or abrasive disks, it can be used to cut lumber, ceramics, slate, marble, tile, nonferrous metals, Transite, corrugated galvanized sheet, and almost any kind of building material.

**Sawing on the Radial Saw.**—This is a development from the old type of swing saw in which the saw blade swung back and forth above a worktable. The modern radial saw is a precision machine which has many adjustments and numerous accessories to crosscut, rip, miter, bevel, make tenons, and cut dados, rabbets, grooves, and tongues. It will also do molding and router shaping, as well as drill, sand, and grind.

**Sawing on the Band Saw.**—This machine can be used for crosscutting, ripping, and cutting curved pieces. The logging industry uses huge band saws for ripping logs into boards of various thicknesses.

**Sawing on the Scroll and the Portable Jigsaw.**—The scroll saw is stationary. The portable jigsaw is an electric tool manipulated by hand. Both will cut either internal or external curves, in addition to straight sawing.

**Planing.**—There are planers known as thickness planers or surfacers, and jointers. There are also electric hand-operated planes for edge planing. Planers vary from the home craftsman's sim-



ple, small edge jointers to heavy, complex industrial machines which plane to thicknesses of close tolerances.

**Boring and Drilling Holes.**—Holes can be bored and drilled with portable electric drills and drill presses. Industrially, the latter often become complex multiunits which are powered automatically. (See Fig. 2.) Drill presses have adapters and accessories to do many additional operations in woodworking, such as mortising, shaping, routing, and sanding.

**Shaping.**—The woodworking shaper is used for shaping straight or curved edges, making molding, and pattern shaping. It may also be used for fluting furniture legs. Shapers have adjustments and molding cutters, or knives, to fit and make any shape of edge design. Hand-operated electric routers are developed to do practically anything that can be performed on a pedestal-type shaper.

**Wood Turning.**—The wood lathe is one of the oldest types of power equipment known, used to fashion wooden objects. The basic processes performed on the lathe consist of turning between live and dead centers, and turning on a faceplate.

Tools used for cutting can be as varied as the designs dictate. Five of the more common woodworking turning tools are the gouge, skew chisel, parting tool, round nose, and diamond point.

**Sanding.**—Sanding furniture and cabinetwork is best done with power sanders. The equipment varies from heavy base-anchored floor-model sanders, with large sanding belts, to hand-operated portable belt sanders. Other power sanding equipment commonly used is the hand-operated orbital sander and the disk sander. There are variations of all of these types.

### JOINERY

Joinery evolved as the craft of a skilled woodworker who did the work necessary for the finishing of buildings. Later, it was applied also to furniture. As noted previously, during the Middle Ages the joiners were a separate craft and guild, as were the carpenters and shipwrights.

In the paragraphs that follow, a number of basic joints are described. Fig. 6 shows a few of the more common ones. Each has special applications and adaptations suited for particular construction needs.

**Butt Joint and Doweled Joint.**—The edge-butt and end-butt joints are two types used frequently. The end-butt joint is assembled and fastened securely with nails, screws, or corner blocks. The edge-butt joint is most often held together with glue; however, corrugated and other types of fasteners may be used sometimes. Wooden dowels are often used to reinforce edge-butt, end-butt, and mortise-and-tenon joints.

**Dado Joint.**—The dado joint is one of the strongest when properly made. A groove is cut across the grain of a piece of wood, and another piece is fitted into it. These joints are used in drawers, shelves, bookcases, and stepladders.

**Rabbet Joint.**—The rabbet joint is similar to the dado, except that the pieces are joined together at the ends. This joint is ideal for certain types of corner construction.

**Lap Joint.**—There are several kinds of lap and notched joints. One of the more common for carpentry and furniture making is the cross-lap joint. Another is the end-lap joint.

**Tongue-and-Groove Joint.**—This is an adaptation of the edge-butt joint in which a tongue, groove, or rabbet is cut in both pieces to make a

firm fit. A common application of this type of joint is in flooring.

**Spline Joint.**—A spline joint may be applied to a miter or an edge-butt joint. It consists of fitting a piece of wood called a spline into grooves of both parts of the joint to give it rigidity, as well as to make it invisible in some cases.

**Dovetail Joint.**—This joint has wedge-shaped fingers cut on the end of one piece of wood which fit into matched socket cuts in the other piece. It can be either a true dovetail or a stop dovetail joint. The latter is commercially used in better drawer construction. The electric router with a special jig or attachment will make a precision dovetail joint.

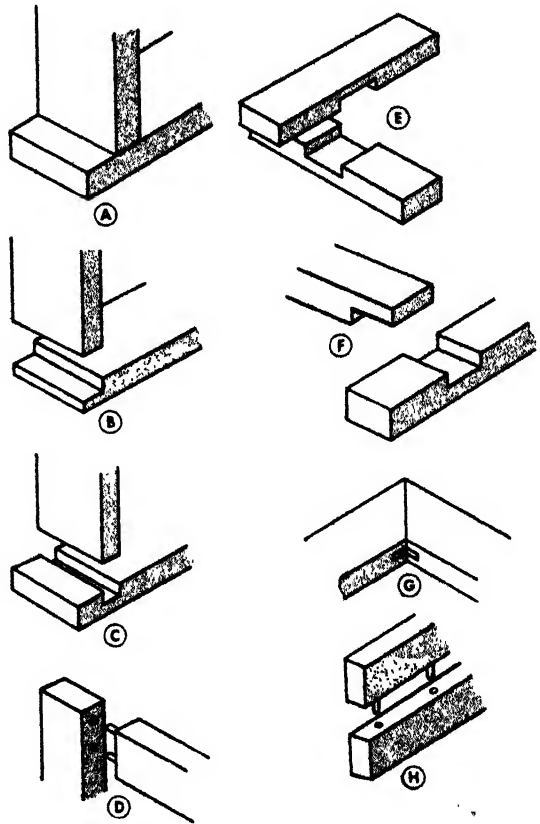


Fig. 6. Some basic joints used in woodworking: (A) butt, (B) rabbet, (C) dado, (D) doweled-butt, (E) cross-lap, (F) middle-lap, (G) splined miter, and (H) doweled-edge.

**Mortise-and-Tenon Joint.**—An accurately made tenon on the end of one piece of wood fits into a mortise cut in the second piece to form this joint. Five of the more popular types of mortise-and-tenon joints are the through, blind, haunched, stub, and miter joints.

### FINISHING WOOD

Wood finishing can be a highly developed skill, and many woodworkers have developed this specialty into an art and a career. Finishes are applied on wood surfaces to serve as a protection, preserve the wood, bring out the beauty of the grain, and also to give ornamental effects. Finishing materials to produce such effects include stains,

bleaches, wood filler, shellac, varnish, sealer, lacquer, synthetics, paint, and enamel.

Equipment and materials used in putting on finishes are brushes, spraying equipment, rubbing abrasive paper, linseed oil, turpentine, alcohol, lacquer thinner, synthetic thinning agents, steel wool, pumice stone, rottenstone, commercial rubbing compounds, rubbing oil, and wax.

**Staining.**—Stain is put on wood to produce a desired color effect, yet preserve the grain pattern of the board. Considerable manufactured furniture is made from relatively inexpensive woods, then stained to resemble such exquisite ones as walnut and mahogany. Oil, water, and spirit are the bases of three widely used stains.

**Wood Filler.**—This material comes in liquid or paste form. It is used to fill the pores of open-grain wood to produce a smooth surface, over which the final finish may be applied. Paste wood filler is made from silex, a ground silicon, which is mixed with linseed oil, japan drier, and turpentine. Filler is usually mixed with colors in oil to secure the tint desired for the final finish.

**Bleach.**—Bleaching is the process of removing the natural color from the surface of wood. This finish is sometimes referred to as blonde, limed, or wheat. Commercial bleaches are prepared as one- or two-solution liquids.

**Shellac.**—One of the oldest finishing materials, used since the 16th century, is shellac. It is the product of the lac insect (q.v.), found in the East Indies and southern Asia. This insect feeds on a resinous material and then leaves a secretion on the tree limbs. After several generations of insects, the secretion forms a coating. This is stripped off by hand and separated from impurities, such as twigs and other foreign matter. It is then heated, strained, and processed into sheets, which later are further refined and dissolved in denatured alcohol to form liquid shellac.

Shellac produces a good finish. It is easily applied, dries rapidly, and rubs out smoothly to make a fairly hard surface. It is not waterproof and, because of this, often serves as a sealer coat for waterproof finishes. It is obtainable in two colors, white and orange. These are the same, except that white shellac has been bleached. Orange shellac is most often used as a primer for painting and for finishing in pattern making.

**Varnish.**—Varnish preserves wood finishes. It can be rubbed with pumice or rottenstone and water and oil to give a beautiful luster. Originally all good varnishes were made from imported fossil gum; more recently, however, synthetic resins have replaced the original basic material. Varnish is available in either transparent or colored forms to make varnish stain.

Varnish stains are sometimes used by the inexperienced woodworker because they give a quick color to a varnished surface. They are generally not suitable for fine, finished furniture, however, because the stain tends to blur the natural grain of the wood. Spar quick-drying varnish is very popular because it is tough, waterproof, and heat resistant.

**Lacquer.**—This material is ideal for finishing furniture. It dries quickly so that successive coats may be put on in a few hours. Lacquer is available clear or in a wide variety of colors. True lacquer was used in China as far back as 3,000 B.C. Eastern lacquer is the natural sap of the lac tree. No other substance, except perhaps a coloring agent and a thinner, is normally added to the natural juice.

**Paint and Enamel.**—Paint and enamel provide protective and decorative coatings for less expensive woods, where a transparent finish may not be desirable. Either can be used satisfactorily as a colorful finish on furniture, cabinets, and interior trim. Paint is generally applied to exterior surfaces or on woods which are exposed out of doors. Enamel is most suitable for interior trim within the home. It usually produces a harder finish than paint, because it contains varnish.

**Penetrating or Wipe-on Wood Finishes.**—These finishes are very popular since they can be applied easily by the home craftsman or the novice in woodworking. Many interesting effects can be obtained according to the intensity of application and the pressure exerted in wiping. These finishes can serve as staining or coloring agents, as well as basic sealers. Clear finishing materials are often used for the final applications for primer pigmented wipe-on coats. Beautiful furniture, interior trim, and wall panels are often treated with these finishes.

See also CARPENTRY; FURNITURE; WOOD CARVING; WOOD ENGRAVING AND WOODCUT.

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**WOODWORTH, wōd'wūth, George Wallace**, American music educator: b. Boston, Mass., Nov. 6, 1902; d. Cambridge, Mass., July 18, 1969. He studied music at Harvard and the Royal College of Music in London and taught at Harvard from 1925, becoming a professor in 1948. He conducted the Radcliffe Choral Society from 1925 and the Harvard Glee Club from 1934, and was organist of Harvard and choirmaster of the Harvard Chapel from 1940. He held all of these positions until his retirement in 1958. National and international tours by his choruses brought him wide renown. His book *The World of Music* was published in 1964.

HERBERT WEINSTOCK

**WOODWORTH, Robert Sessions**, American psychologist: b. Belchertown, Mass., Oct. 17, 1869; d. New York, N.Y., July 4, 1962. He studied at Amherst and Harvard, and took the doctorate in psychology at Columbia in 1899. After three years of teaching physiology in New York City hospitals and a year of study with Charles S. Sherrington at Liverpool, England, he joined (1903) the faculty of Columbia, where he was professor of psychology until 1942 and continued to lecture until 1958. At Columbia he supervised the doctoral studies of many who came to occupy major positions in American universities.

Woodworth's first important research publication, undertaken with Edward L. Thorndike, was a vigorous attack on the concept of generalization



GEORGE GENSER/PHOTO RESEARCHERS

In Australia sheep are raised in large flocks, often on poor land not suited for agriculture. Modern shepherds use motorcycles and four-wheel-drive vehicles to travel with the flock as the sheep graze on the open land.

in learning. Transfer of training, they held, occurs only when the learner perceives identical elements between skills or ideational material formerly acquired and the new material to be mastered. In 1911 he revised and extended a famous textbook on physiological psychology originally written by George T. Ladd. His *Experimental Psychology*, long used in mimeographed version by scores of graduate students, appeared in 1938. Revised by Harold Schlosberg in 1954, it remains one of the most important handbooks of experimental psychology in the English language. His textbook *Psychology* (1921), written for beginning students, though by no means comparable to William James' basic textbook, became one of the best sellers in its field.

Woodworth believed that Edward B. Titchener and John B. Watson were especially mistaken in their theories and procedures. William McDougall he regarded as too metaphysical. Psychology, Woodworth taught, should concentrate on functions or activities, both mental and physiological. The handicaps of language must be surmounted, and the nouns customarily used in psychology ought to be thought of as verbals. Thus, it is incorrect to say that a person has high intelligence. The sentence really means that the person behaves very intelligently. Likewise, "memory" does not exist as an entity but rather connotes such functions or activities as learning, retaining, recalling, and recognizing.

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Professor of Psychology, Bucknell University

**WOOF or WEFT.** See **WEAVING, HAND LOOM; TAPESTRY—Technique.**

**WOOL**, the animal fiber forming the protective covering of the sheep, usually white in color, though the degree of whiteness may vary considerably. It may be also creamy yellow, gray, brown, or black, but there is no noticeable difference in structure or properties between wool of these colors and white wool. The outside of the wool fiber is made up of flat, irregular scales that overlap like roof shingles. The fiber grows with a crimp—a wavy form which gives excellent properties of elasticity and resilience. Some of the individual fibers are short, others long; some are fine, others coarse. Basically, length and fineness determine the purpose for which the fibers can best be used.

Chemically, wool is a protein called keratin and is made up of about 18 different amino acids, which are linked to one another to form long, coiled molecular chains, shaped somewhat like a coiled spring. Individual chains are linked to each other by chemical (disulphide) cross-links. Branching off the chains are reactive chemical sites (side groups of some amino acids). The molecular chains uncoil when wool fibers are stretched or distorted, but tend to assume their original shape when the stretch force is removed. Wool fabrics, as a result, shed wrinkles easily and are long wearing because of the unique elasticity of the wool protein. The reactive side groups are easily modified by chemicals to give new wool properties, and they also readily attract dyestuffs.

**Woolgrowing.** The domesticated sheep is raised in virtually every country of the world, in several hundred varieties, differing in appearance and in the type of wool produced. These variations result from differences in soil, climate, pas-



GRANT HEILMAN

An expert can shear a sheep quickly, cleanly, and with no pain to the animal. A freshly shorn sheep is seen against the fence.

turage, and breed. No two fleeces, even from the same type of sheep and the same geographic area, are exactly alike. There are, however, three major types of sheep: (1) mutton types, raised primarily for meat; (2) wool types, raised principally for wool; and (3) dual types, raised for both meat and wool.

Most sheep are raised either on large ranches, where they constitute the principal profit-making product, or on small farms with diversified crops and livestock. The first type of enterprise prevails in Australia, New Zealand, South America, and the western United States; the second type in the midwestern United States, England, and continental Europe. In addition, large numbers of sheep are raised under primitive conditions in remote mountain districts, such as the Highlands of Scotland, the Pyrenees of Spain, and the plateau of Central Asia. Sheep raising does not require extensive equipment or heavy labor, but it does necessitate constant attention. Most sheep farms are located in hilly or rough areas on land unsuited to other agricultural enterprises. To distinguish the sheep in each flock, raisers generally mark the animals with paint or a stamping compound. Sheep flocks in Australia may number more than 100,000 head, but flocks ranging from 2,000 to 5,000 are most common. Most flocks in the United States run about 1,000 head, but there are herds as large as 50,000.

Sheep are generally shorn once a year, and within a year's time their wool may grow to lengths varying from 1 inch to 15 or more inches. The shearer works with a power machine, resembling a barber's electric clippers, which removes the whole fleece in one piece; an expert can clip between 100 and 200 sheep in a day. Wool obtained in this way is called shorn wool, whereas the fleece taken from the pelts of lambs or sheep slaughtered for meat is known as pulled wool. Of the two classes, shorn wool is the pre-

dominant type, produced in by far the greater quantities.

The raw wool comes to the manufacturer or mill in the form of fleeces, which are packed or shipped in bags or bales. The weight of the bags or bales varies in the different wool-producing areas. Australian and New Zealand bales, for example, weigh about 300 pounds; South African bales, about 370 pounds; South American bales, 1,000 pounds; and United States bags, from 225 to 350 pounds.

**Types of Wool.** There are two broad classifications of raw wool based on ultimate use: apparel-class wools and carpet-class wools. Carpet wools are coarser and usually longer than apparel wools. Comparative quality is designated in the wool trade by either the numerical or the blood

The diagram shows variations in fleece quality: the lower the number, the higher the quality.

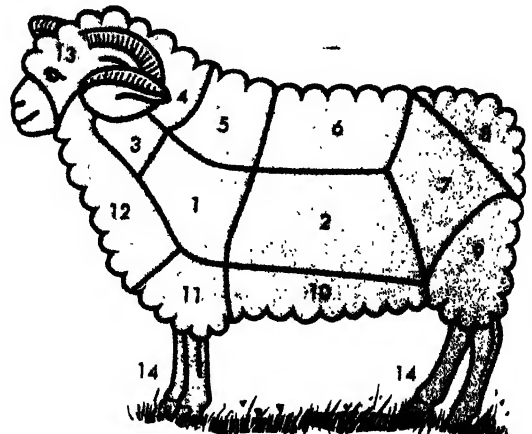


Table 1—APPAREL WOOL GRADES

Blood system	Count or numerical system
Fine	64's, 70's, 80's
Half blood ( $\frac{1}{2}$ blood)	60's, 62's
Three-eighths blood ( $\frac{3}{8}$ blood)	56's, 58's
Quarter blood ( $\frac{1}{4}$ blood)	48's, 50's
Low-quarter blood	46's
Common	44's
Braid	36's, 40's

Source: Albert M. Hermie, *Prices of Apparel Wool*, Technical Bulletin No. 1041, U. S. Dept. of Agriculture, p. 5 (Washington 1951).

system, both of which assign market grades to the various types of wool. The blood system, peculiar to the United States, is compared with the numerical or English system in Table 1. Fiber diameter, length, and general fiber soundness are primary considerations in the evaluation of each of these grades for use and marketing purposes. Among other important properties are contour, crimp, color, and the felting property.

Fine wool has a length of  $2\frac{1}{2}$  to 5 inches, up to 2,400 "surface" scales to the inch, and a diameter of about  $\frac{1}{2000}$  of an inch. Only pure Merino sheep or breeds with predominantly Merino blood produce fleeces classified as fine wools. These sheep are found principally in Australia, South Africa, and the United States. About 60 percent of the world's apparel wool is produced by crossbred and medium-wool sheep, such as the Corriedale, Southdown, Shropshire, Hampshire Down, and Dorset Down. This type of wool is grown principally in the United States, the United Kingdom, Australia, New Zealand, and South America.

Carpet wools are produced in all parts of the world by sheep that usually live under primitive conditions. A large proportion of these sheep are raised in African or Asian countries, among them the Somali, Hirrik or Iraqi, Sikkim Bera, and Tatarian breeds. Their wool consists of a long outer coat of hair protecting an undercoat of true wool.

**Wool Supply.** The annual world production of wool has been increasing steadily. Since 1956, it has exceeded 5 billion pounds (greasy basis), of which about 80 percent is classified as apparel wool and 20 percent as carpet wool.

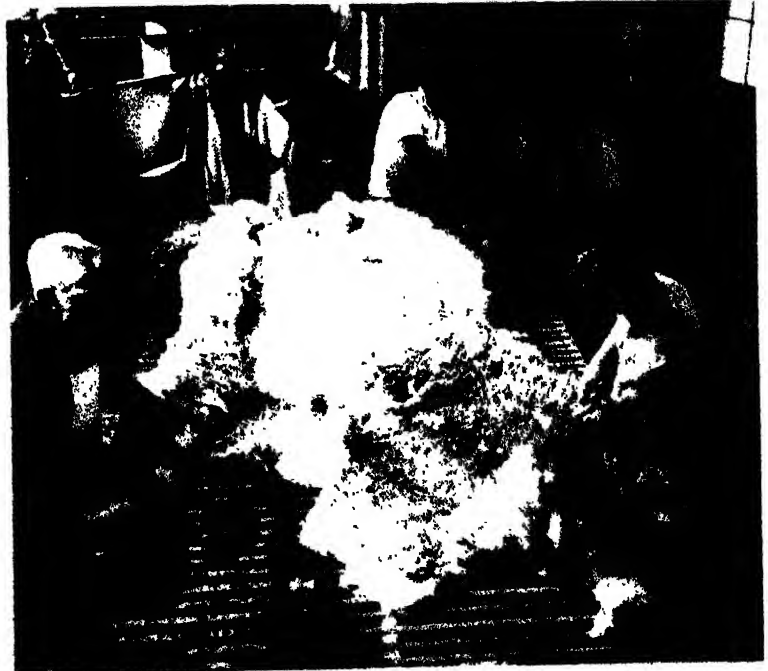
Australia is the largest producer of wools in the world and the leading supplier of fine wools. Five countries of the Southern Hemisphere (Australia, New Zealand, South Africa, Argentina, and Uruguay) produce almost three fifths of the total world supply and about three fourths of the supply of apparel-class wool. Most of this wool is shipped thousands of miles across the world to countries such as the United States, which have large populations and insufficient wool supplies. The United States and the United Kingdom, which are the chief apparel wool consumers, also produce important quantities of this type of wool. The principal sources of carpet wools are the USSR, Argentina, Turkey, India, and China, which account for 45 percent of the total output of this class. The Balkan countries, New Zealand, Iran, Pakistan, Iraq, and the former French territories in North Africa produce the bulk of the remaining 55 percent.

## WOOL PRODUCTION

Rank	Country	U. S. Tons (millions)	Metric Tons (millions)
1	Australia	780	710
2	Soviet Union	475	430
3	New Zealand	330	300
4	Argentina	195	175
5	South Africa	110	100
6	Uruguay	66	60
7	Turkey	55	50
8	United States	55	50
9	United Kingdom	55	50
10	Brazil	39	35
11	India	39	35
12	Iran	33	30
13	Spain	33	30
14	Pakistan	28	25
15	France	22	20

Source: Commonwealth Secretariat, London, 1976.

Merino fleece is being sorted at a ranch in Tasmania, Australia. The sorting of fleece is a highly skilled craft. It is required because variations in fineness, length, and color affect selection for use in particular products.



FREDERICK AYER/PHOTO RESEARCHERS





© J. ALLAN CASH/PHOTO RESEARCHERS

Wool-carding machines, which produce rovings (ropes of wool) for spinning, are in operation in a mill in Uruguay.

**Marketing.** The world's annual wool supply is marketed by two principal methods: (1) private or cooperative trading among growers, dealers, and manufacturers; and (2) auction selling by open competitive bidding. Practically the entire domestic production of the United States is marketed by the first method, while a number of other countries, including Australia, New Zealand, and South Africa, favor the auction method. Important wool marketing centers are located in Sydney, Australia; London, England; Boston, Mass.; and Buenos Aires, Argentina.

Another phase of wool trading is the wool futures market, where standard wool contracts, for either raw wool or wool top, are bought and sold by growers, merchants, and consumers. These contracts specify certain quantities and qualities of wool for future delivery. They are traded to obtain price insurance (hedging), to minimize losses on cash transactions or inventories of wool and processed wool goods, or to speculate for profit.

**Uses and Manufacture.** Wool is used chiefly to make woven and knitted apparel, but there are many other wool products, such as blankets, carpets, rugs, upholstery, draperies, industrial cloths, and felt. Because of its unique characteristics, wool sustains major segments of the textile and apparel industries.

The first step in preparing wool for manufacture into fabrics is sorting the varieties of wool. Fabrics made from wool for apparel purposes are woven or knit from woolen or worsted yarns, or made by felting the unspun fiber. Preparatory to making yarn, wool fibers of similar characteristics are carefully blended and then put through a

process known as carding in order to disentangle locks and bunches of fibers and to remove very short fibers, any remaining bits of burrs, and vegetable matter. The carding operation can be compared to combing and brushing one's hair. The process produces roving—a rope of wool adaptable for spinning into yarns. From this point, processing differs, depending on whether woolen or worsted yarn is desired.

Manufacturing woolen yarn utilizes a wider range of raw material, and there is more variety in the finished product. Woolen yarns require less processing to be made into cloth, since they are spun directly after carding. They are also more open, hairy, and irregular than worsted yarns.

Worsted manufacturing requires a combing process after carding, to remove the shorter fibers (noils) from the longer fibers; the noils are collected and used in making woolen yarns or pressed felts. The wool roving that comes from the cards in worsted manufacture is a web of fibers condensed into a thick strand adaptable for feeding into the worsted comb. The comb forms the longer fibers into a thick, uniform strand known as wool top, which then is reduced in size to a roving by being drawn through rollers for mixing and parallelization. When wool top is of a predetermined thickness and weight, it is ready for spinning into yarn.

Many wool products are woven on looms. In weaving, two sets of yarns are interlaced at right angles to each other. One, called the warp, runs lengthwise in the loom; the other, called the filling or weft, runs crosswise. The filling threads pass over and under the warp threads, alternately or at longer intervals.

Woolen and worsted fabrics generally vary in width between 54 and 60 inches. The length of a piece or cut is usually 50 to 70 yards, but in a few cases it may run from 120 to 140 yards.

Woolen and worsted cloths go through a series of finishing processes after they leave the loom. The primary object in finishing is to enhance the quality of the cloth by giving it a specific appearance and handle. There are two main groups of finishes for wool fabrics: clear finish and face finish, with modifications of both. Clear-finished fabrics, which include most worsted fabrics, have an even, unnapped surface, the weave and the colors being prominently developed. Face-finished fabrics, on the other hand, have a distinct nap or pile of fibers on the surface, a more indistinct weave, and usually more subdued and softened colors.

Wool may be dyed in any manufacturing stage. Sometimes the fiber is dyed immediately after scouring; in other cases, wool is dyed in the top, at the yarn stage, or in the finished fabric. In addition, wool fabrics are sometimes printed for use as neckwear, blouses, dresses, or beachwear.

Woolen and worsted yarns are knit by machine into such products as hosiery, sweaters, and cloth, the last to be made into coats, dresses, and other products. In addition, woolen and worsted yarns are prepared and marketed for hand knitting. Yarns used in carpet and rug manufacturing are usually coarser than those used in making apparel.

Wool felt is manufactured by a separate division of the wool textile industry, using a method handed down from antiquity. The felting property, which causes the fibers to adhere closely, is a prominent characteristic of wool. Felts are made from masses of unspun fibers by firmly enmeshing them through a combined mechanical-chemical

action that includes treatment by moisture and heat. Unwoven felts are used widely in the hat-making trades and for covering metallic and other surfaces in industry. Woven felt is used extensively in the piano industry, in printing, and in the chemical and optical trades. See also FELT.

**Fabric Treatment.** Scientists have learned that a marked protection of wool against loss of tensile strength can be obtained by using a surface agent on the fiber during processing. Addition of a nonionic surface-active agent to sulphuric acids was found also to give stronger yarn.

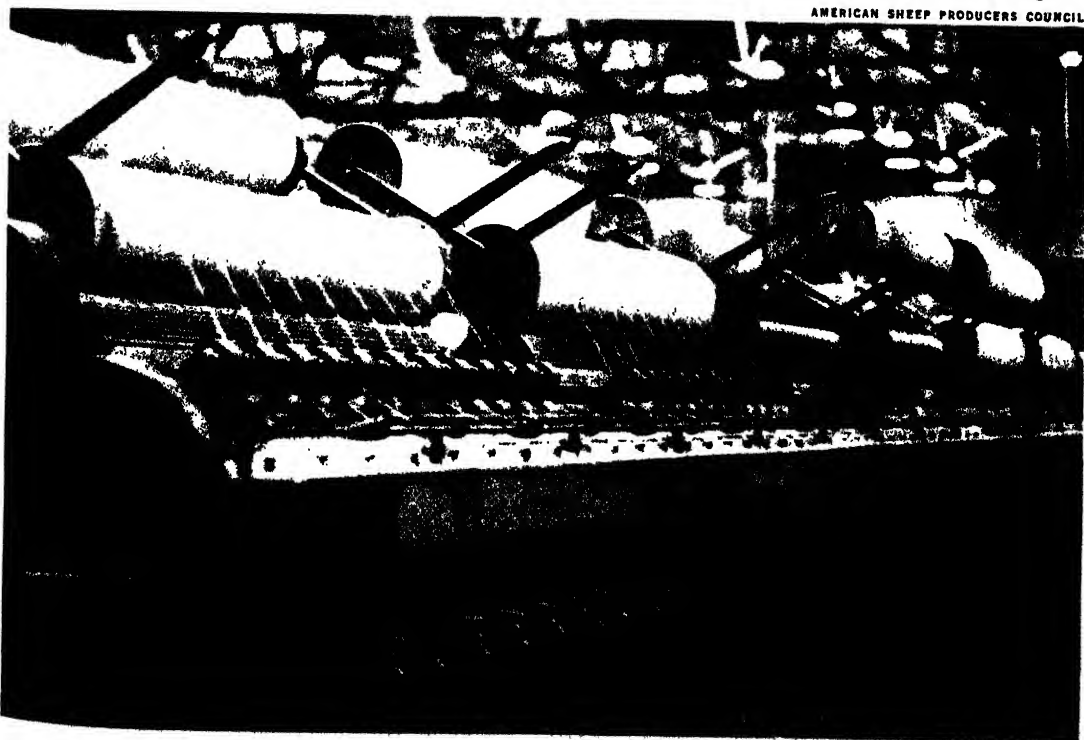
Treatments have been developed to protect wool products from attacks by insect larvae, such as moths and carpet beetles. The ideal mothproofing agent is required to be effective at low concentrations that are nontoxic to the wearer, and also to be undetectable by color or odor and to remain toxic to larvae after long exposure to light and air. One such general purpose insecticide now popular is of the chlorinated hydrocarbon type.

For years scientists have sought a process for shrinkproofing wool products. One development, introduced in 1961, enables all-wool products to retain their original characteristics when placed in home washing machines and drying machines. This process is based on the treatment of wool with potassium permanganate in concentrated common salt solution, followed by a clearing of these chemicals with sodium bisulphite. There are many other processes, one of which is referred to as interfacial polymerization. Here the product is dipped into a water solution of hexamethylenediamine and then into a solution of sebacoyl chloride in a standard solvent.

The elasticity of wool fibers causes the desired creases in wool products to be unstable. Methods

High-speed spinning machines convert ropes of wool into tightly twisted yarns suitable for weaving.

AMERICAN SHEEP PRODUCERS COUNCIL





RICHARD DIBON-SMITH/PHOTO RESEARCHERS

Harris tweed is still woven by hand on the island of Lewis with Harris in the Outer Hebrides of Scotland.

have been developed for imparting permanent creases and pleats to 100 percent wool trousers and skirts without altering the recognized desirable characteristics of wool. One method, developed in Australia, involves application of a wool-setting chemical to the finished garment. A variation of this method treats fabrics at the mill with a wool-setting chemical. This remains in the cloth until activated by steam and baking, applied by the garment makers. The latter is referred to as "presensitized" fabric.

**Reclaimed Wool, Secondary Raw Materials, and Byproducts.** Because of wool's durability and relatively high cost among textile fibers, wool textile manufacturers use mill waste as well as reprocessed and reclaimed wool to make inexpensive fabrics for certain markets. In addition, other fibers are sometimes blended with wool to lower the manufacturing costs and retail prices of fabrics, to add strength, or to produce special effects.

Wool grease, known in its purified form as lanolin, is an important byproduct of the wool industry. It enjoys a wide industrial use in the production of pharmaceuticals, cosmetics, cutting oils, printing inks, lubricating greases, rust preventives, and varnishes.

**Specialty Hair Fibers.** Most of the wool we use comes from the sheep, but certain other animal fibers, which are closely related to wool and are basically termed wool, are used alone or in conjunction with sheep's wool to make clothing and other types of fabrics. These fibers come from the covering of goats, camels, llamas, alpacas, vicuñas, and certain fur-bearing animals. The specialty hair fibers, as they are called, are employed to add special effects of beauty, color, softness, or luster to fabrics.

**Wool Products Labeling.** In the United States wool producers, manufacturers, distributors, and consumers are protected against misrepresenta-

tion of wool products by the Wool Products Labeling Act, enacted by Congress in 1939. This law requires the labeling of all products containing wool except upholstery and floor coverings, and stipulates that the label show the percentage of total fiber weight represented by each kind of wool or other fiber present in a wool product. The term "wool" is defined in the act to mean the fiber from the fleece of the sheep or lamb or from the hair of the Angora goat, Kashmir (Cashmere) goat, camel, alpaca, llama, or vicuña, which has never been reclaimed from any woven or felted wool product; it may be reclaimed from spun yarn. Reprocessed wool is defined as wool fiber that has been reclaimed from woven or felted materials that have never been utilized in any way by the ultimate consumer. Reused wool is defined as wool fiber reclaimed from used or worn wool products. Virgin or new wool, as defined in the regulations under the act, is wool fiber that has never been in any way used, or reclaimed, reworked, or reprocessed from any spun, woven, knitted, felted, or manufactured product. Wool upholstery and wool carpetings are subject to the Textile Fiber Products Identification Act, effective March 1960.

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#### WOOL GLOSSARY

- All-over Patterns.**—Patterns that cover the entire surface, as opposed to broken patterns, which appear in "repeats."
- American Spun.**—Wool yarns for worsted cloth construction, spun by a method developed in the United States. The process eliminates several steps used in the French and Bradford systems. See also *Bradford Spun* and *French Spun* in this glossary.
- Astrakhan.**—A heavy, curly pile fabric imitating the fleece of the karakul lamb. A luster wool is used in the worsted construction, along with slack twist yarns.
- Basket Weave.**—A loosely or tightly woven fabric in which two or more yarns are woven together in an over-and-under pattern, similar to that used in basketry.
- Blanket Cloth.**—A heavyweight woolen coating with a soft, raised finish.
- Bouclé.**—An over-all curly, loopy-faced fabric woven or knitted with special-effect yarns known as loop, curl, or bouclé.
- Bradford Spun.**—Yarn spun by the most universal of three systems of spinning. The system uses the circular or Noble comb for removing short wool fibers. See also *American Spun* and *French Spun* in this glossary.
- Broadelcloth.**—An elegant lustrous wool fabric with a flatly napped surface.
- Brushed Wool.**—Wool fabrics that are loosely woven so that the fiber may be brushed up on the surface, to

hide patterns and warp and filling characteristics in mill-finished goods.

**Challis.**—An extremely lightweight, softly finished wool worsted fabric.

**Cheviot.**—A heavily fulled, hairy-napped wool cloth of either woolen or worsted construction. Wool from the Cheviot sheep was originally used, providing the rough surface characteristic of this cloth.

**Covert.**—Tightly woven wool with a firm texture and sharply angled lines.

**Crepe.**—A wool fabric made of fine, tightly twisted yarns, which may have a flat, grainy, or crinkled surface, depending on the amount of twist given to the yarns.

**Doeskin.**—A smooth, closely woven wool cloth with a soft, peach-skin surface that completely obscures the weave.

**Faille.**—Plain-weave wool cloth with heavier yarns in the filling than in the warp. It produces a flat, horizontal-ribbed fabric.

**Felt.**—A matted or web product made by applying heat and moisture to wool fiber. See also separate article **FELT**.

**Flannel.**—A cloth or fabric woven in both woolens and worsteds with a soft, slightly napped surface, used in suits, dresses, coats, dressing robes, and children's wear.

**Fleece.**—A heavy wool coating with a deeply napped surface which may be shaggy or close cropped.

**French Spun.**—Yarn spun by a system using a rectilinear comb for removing short wool fibers. Shorter fibers are used than in the Bradford system. See also *American Spun* and *Bradford Spun* in this glossary.

**Gabardine.**—A finely woven, finely twilled, clear-faced wool worsted fabric characterized by closely set diagonal ribs.

**Harris Tweed.**—A soft tweed spun, dyed, and handwoven in the southern part of the island of Lewis with Harris, Outer Hebrides, Scotland.

**Herringbone.**—A variation of twill weave which produces a pattern of continuous arrows.

**Homespun.**—A general term applied to loosely woven fabrics made from irregular woolen yarns. It has a rustic look.

**Hopsacking.**—A rough, loose-textured fabric made with a basket weave or basket-weave effect.

**Jersey.**—A flat knitted fabric, very elastic and pliable, used for many articles of dress, including blouses, shirts, bathing suits, gloves, and dresses.

**Lamb's Wool.**—Wool shorn from a lamb, up to eight months old, which never before has been clipped. It is noted for being especially soft in hand.

**Looped Fabric.**—A term applied to fabrics with bubbly, curly, loopy surfaces.

**Melton.**—A thick, heavyweight woolen fabric with the weave hidden by a smooth, feltlike surface.

**Overcheck.**—A design in which one check pattern is woven over another in a different size or pattern. It may also be a check pattern on a solid color ground.

**Serge.**—A right-hand-twill weave, clear-finish wool cloth, known for its durability and diagonal-rib look.

**Sharkskin.**—A hard-finished wool worsted fabric having a simple color pattern, for example, one color with white. The fabric is characterized by a delicate pebbly surface.

**Shetland.**—Properly, wool from sheep raised on the Shetland Islands off Scotland. It has a soft nap and shaggy surface of protruding fibers.

**Tweed.**—A strong wool fabric with a rough or fuzzy surface, which can be woven into monotone color blends and figured patterns such as checks and plaids.

**Twill.**—A wool worsted fabric with a steep, prominent diagonal rib. A distinct cut-line separates the ribs.

**Velour.**—A dressy coating fabric with a thick, raised pile and soft hand.

**Wool.**—The soft, curled coat of the sheep. Well-known breeds are the Corriedale, Cheviot, Cotswold, Dorset Horn, Merino, and Romney. In the United States, under the Wool Products Labeling Act of 1939, wool is defined as the fiber from the fleece of the sheep or lamb or from the hair of the Angora goat, Kashmir (Cashmere) goat, camel, alpaca, llama, or vicuña, which has never been reclaimed from any woven or felted wool product. It may be reclaimed from spun yarn.

**Wool Velvet.**—A luxury fabric distinguished by a deep, rich, cut-pile surface, soft and velvety in feeling.

**Woolen.**—A term applied to fabrics woven or knitted from loosely twisted yarns spun generally from shorter wool fibers. A soft, napped surface is a characteristic of woolen fabrics.

**Worsted.**—A term applied to fabrics woven from tightly twisted wool yarns that are spun from long, fine, carefully combed wool fibers. A firm, crisp hand is a characteristic of worsted fabrics.

**WOOLF, woolf, Arthur**, English engineer and inventor: bap. Camborne, Cornwall, England, Nov. 4, 1766; d. The Strand, Guernsey, Oct. 26, 1837. After serving his apprenticeship as a carpenter in Cornwall, he went to London, where he became a master engineer in 1795 and in the following year engineer for a brewery, a post he held until 1806. Meanwhile, he patented a new boiler (1803) and improvements in the steam engine (1804, 1805). He went into partnership with Humphrey Edwards in 1806 and four years later took out a patent on his best-known invention, the Woolf engine, the first practical compound engine. Dissolving his partnership in 1812, he returned to Cornwall, where he devoted himself to improving the mechanics of mining and was superintendent of an engine-manufacturing works at Hayle.

**WOOLF, Leonard Sidney**, English author and publisher: b. London, Nov. 25, 1880; d. Rodmell, Sussex, Aug. 14, 1969. He held scholarships at St. Paul's School and Cambridge. He then was a member of the Civil Service in Ceylon from 1904 to 1911, when he resigned and returned to England to try his hand at writing. In 1912 he married Virginia Stephen (see **WOOLF, VIRGINIA**), and together they contributed much to the literary and intellectual excitement of the Bloomsbury district of London.

Woolf's first book was a novel based upon his experiences in Ceylon, *The Village in the Jungle* (1913), exposing evils of colonialism. With the advent of World War I he gave up fiction for politics and sociology and began, as a journalist, to contribute to the *New Statesman*, the *Nation*, and other periodicals. He was also on the editorial staff of review journals and political quarterlies and was an active member of such organizations as the Fabian Society and the Labour Party. The following books project his interest in socialism, the cooperative movement, anticolonialism, and international government: *International Government* (1916), *The Future of Constantinople* (1917), *Co-operation and the Future of Industry* (1918), *Empire and Commerce in Africa* (1920), *Socialism and Co-operation* (1921), and *Imperialism and Civilization* (1928).

During the 1920's Woolf undertook a study of "communal psychology," the relationship between political thought and action during the past two centuries, and wrote *After the Deluge* (2 vols., 1931-39), which deals with developments in democracy up to the year 1848. A third volume, *Principia Politica: a Study of Communal Psychology* (1953), treats the 20th century clash of liberty and authoritarianism.

In 1917 he and Virginia Woolf had bought a small printing press and begun the Hogarth Press as an amateur enterprise. It became a notable success, and after his wife's death it was reorganized with associate directors. He edited three volumes of posthumous miscellanea by Virginia Woolf and during her life was her most trusted editor and critic. After World War II he continued to write books concerned with international politics and world government. A rebel against Victorianism and the empire, he never ceased to devote himself to a rational pursuit of truth and justice as writer, publisher, and practical politician.

**Further Reading:** Woolf, Leonard, *Autobiography of Leonard Woolf*, 5 vols. (Harcourt 1975).

**WOOLF, Virginia** (nee **ADELINE VIRGINIA STEPHEN**), English novelist, short-story writer, and critic: b. London, England, Jan. 25, 1882; d. Lewes, Sussex, March 28, 1941. The second daughter of Sir Leslie Stephen (q.v.), she was only 13 at the death of her mother, the former Mrs. Julia Duckworth, to whose beauty and nobility of character Henry James paid tribute. Virginia's combination of humanity and reserve reflected that of her parents. She was educated through "the free run of a large and unexpurgated library," owned by her father. When he died, in 1904, she moved, together with her sister Vanessa and brothers Adrian and Thoby, to Gordon Square, Bloomsbury, London. The first of her many reviews for the *Times Literary Supplement* dates from 1905. The death of her brother Thoby in 1906 gave a further shock to her delicate health, already affected by the death of her father. In 1907 she settled in Fitzroy Square, London, with her brother Adrian, her sister having married the art critic Clive Bell. The meetings of the Bloomsbury Group began at this time, and Virginia started to formulate the critical ideas and theories which preceded her creative career. In 1912 she married Leonard Sidney Woolf (q.v.), and together they launched the Hogarth Press in 1917.



Virginia Woolf

Gisèle Freund

Virginia Woolf's first novel, *The Voyage Out* (1915), is comparatively conventional and autobiographical, though she is already concerned with what she calls in her next novel, *Night and Day* (1919), "arrows of sensation striking strangely through the envelope of personality which shelters us so conveniently from our fellows." The merging of the individual consciousness with the world of sensation or nature leads to the disappearance of character and plot as they existed in the traditional, realistic novel. This method is further developed in the impressionistic study of a talented young man's world, *Jacob's Room* (1922), and in *Mrs. Dalloway* (1925), a complex image of life revealed through the thought and action of a single day in London. The conflict between the art of living (the social graces in which Mrs. Dalloway excels) and the masculine worlds of thought and action, or the actual horrors of existence as it has to be lived by some are also themes of her next and finest novel, *To the Lighthouse* (1927). After the extreme fantasy of *Orlando* (1928) and the symbolism of *The Waves* (1931), her creative urge declined. The next novel, *The Years* (1937), treats repetitive cycles of a London family. In the meantime, she had turned to

biography, alternating between the fancifulness of *Flush* (1933), on Elizabeth Barrett Browning's dog, and a friendly tribute, *Roger Fry* (1940).

Virginia Woolf had experienced mental collapses early in life and finally committed suicide by drowning. Her best critical essays are contained in *The Common Reader* (1925; 2d series 1932). *A Room of One's Own* (1929) is rather strident in its feminism; likewise *Three Guineas* (1938), in its ridicule of masculine pomposity. Leonard Woolf edited several volumes of her criticism, published posthumously. He also printed her final novel, *Between the Acts* (1941), completed just before her death; a collection of short stories, *A Haunted House* (1943), including the major part of *Monday or Tuesday* (1921); *A Writer's Diary* (1953); and *Letters* (1956), collected and edited by Leonard Woolf and James Strachey from her correspondence with Lytton Strachey.

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**WOOLLCOTT, wŏl'kŏt, Alexander (Humphreys)**, American essayist and journalist: b. Phalanx, N.J., Jan. 19, 1887; d. New York, N.Y., Jan. 23, 1943. After graduating from Hamilton College in 1909, he became a reporter for the New York *Times* and was promoted to drama critic in 1914. During World War I he was assigned to the Army newspaper *Stars and Stripes*. After the war he returned to his post as drama critic on the *Times* but left it in 1922 for the New York *Herald* and from 1925 to 1928 reviewed for the New York *World*. He then began a popular radio program as "The Town Crier" and gained considerable fame as an eccentric public personality, a raconteur, and an arbiter of popular reading. He also edited a column, "Shouts and Murmurs," for the *New Yorker*.

Woolcott's books, though mostly collections of journalistic writing, reveal the qualities that made him famous as a conversationalist and radio entertainer. These essays and sketches display his excitable enthusiasms, acid quips, and genius for anecdotes and gossip. Representative volumes are *Shouts and Murmurs* (1922), *Enchanted Aisles* (1924), *While Rome Burns* (1934), and *Long, Long Ago* (1943). He collaborated with George S. Kaufman in writing the plays *Channel Road* (1929) and *The Dark Tower* (1934); performed in S. N. Behrman's *Brief Moment* (1931) and *Wine of Choice* (1938); and eventually starred briefly in a road production of *The Man Who Came to Dinner* as Sheridan Whiteside, a character that Kaufman and Moss Hart modeled upon Woolcott himself. Since his writing captured the wit and originality so characteristic of his personality, his informal



essays have survived the ephemeral fate that has historically been the lot of most mere newspaper journalism.

WILLIAM BRACY.

**WOOLLETT**, wōl'ət, **William**, English engraver and etcher: b. Maidstone, Kent, England, Aug. 15, 1735; d. London, May 23, 1785. Apprenticed at an early age to John Tinney, Fleet Street engraver, Woollett later studied pictorial art at the St. Martin's Lane Academy, where he distinguished himself in such subjects as anatomy and perspective. He soon became preeminent among English reproductive line engravers and won European renown with *The Death of Niobe* (1761), after Richard Wilson's painting. In 1775 he received an appointment to be engraver to George III.

Woollett's two most celebrated works, after pictures by Benjamin West, are *The Death of General Wolfe* (1776) and *The Battle of La Hogue* (1781). Hampered by near-sightedness and the necessity of using a magnifying glass, he was a slow worker, often collaborating with other men. In all, he completed 123 engravings over the course of his lifetime. Most of them were landscapes after Claude Lorrain and his English imitators. Woollett's remarkable output, considering his handicap, constituted an achievement which secured him a mural tablet in Westminster Abbey after his death.

Woollett's landscapes seem to capture the measure and balance of the Augustan language of his day as expressed in such a poet as James Thomson. His practice of having a preliminary etching, followed by a second and even third biting, as the foundation upon which to exercise the graver or burin fixed the method and contribution of the English school of engraving. Working with the burin along the furrows of the etched copper plate, Woollett created the classic look of brightness that falls from the skies to drench the foliage and to meet the silver and gold rising from the waters. In portraits he was equally successful. Here he used his considerable skills to maximum advantage, teasing the lines of expressive tension in face or hands to reveal colorations of mood and transparencies of character.

PHILIP RODDMAN.

**WOOLLEY**, wōl'ē, **Celia Parker**, American settlement worker and clergyman: b. Toledo, Ohio, June 14, 1848; d. Chicago, Ill., March 9, 1918. After graduating from the Coldwater Female Seminary in Michigan, she married Jefferson H. Woolley, a dentist, in 1868; eight years later the couple moved to Chicago. There Celia Woolley became interested in the cultural and civic life of the city and developed her talent for writing. Her lifelong interest in religion led her to study for the ministry, and at the age of 46 she was ordained in the Unitarian Church. From 1893 to 1898 she held pastorates in the church but then resigned to return to writing and lecturing. Her urge to serve society finally led her to the field of social work, and in 1904 she established the Frederick Douglass Center on the south side of Chicago for work among the black population. Together with her husband, Woolley lived at the settlement the rest of her life, working tirelessly for the betterment of race relations and gaining the cooperation of many important figures in the city.

**WOOLLEY, John Granville**, American prohibitionist: b. Collinsville, Ohio, Feb. 15, 1850; d. Granada, Spain, Aug. 13, 1922. After graduating from Ohio Wesleyan University in 1871, he studied law and was admitted to the bar in 1873. He practiced successfully in Paris, Ill., and Minneapolis, Minn., and then about 1885 began practicing in New York City.

Some years earlier he had become addicted to alcohol, which caused him severe problems, but in 1888 he effected a self-reform and became a prohibitionist. His earnestness in helping others to overcome the habit brought a position of world leadership in the prohibition movement. During his speaking tours, while lecturing in many countries to large audiences, he was noted for his sympathy and kindness toward those who had problems with alcohol.

Woolley became editor of the *New York Voice* (later *New Voice*), a prohibition organ, in 1899 and continued in this capacity for seven years. In 1900 the Prohibition Party nominated him for the presidency of the United States, and in the election he received 208,914 votes. For the next 20 years Woolley continued with his prohibition work and died while on a fact-finding tour concerning the issue of alcohol abuse in Europe. Woolley's writings, which were popular with prohibitionists of the time, include *Seed* (1893); *The Christian Citizen* (1900); *A Lion Hunter* (1900); *South Sea Letters*, with his wife (1906); and *Civic Sermons* (8 vols., 1911).

**WOOLLEY, SIR (Charles) Leonard**, English archaeologist: b. London, England, April 17, 1880; d. there, Feb. 20, 1960. He began his professional career as assistant keeper of the Ashmolean Museum, Oxford. His first archaeological work abroad was in Nubia with the Eckley B. Coxe, Jr., Expedition (1907-1911) and the Oxford University Expedition (1912). With the assistance of T. E. Lawrence he conducted excavations for the British Museum at Carchemish (1912-1914), a site to which he returned in 1919 after having been a prisoner of war in Turkey. Woolley's reports of these excavations were subsequently published in *Carchemish*, 3 vols. (1914, 1922, 1953).

After a season at Tell el Amarna (1921-1922) for the Egypt Exploration Society, Woolley began the work for which he is best known, the excavations at Ur (q.v.) in Iraq on behalf of the British Museum and the Museum of the University of Pennsylvania. This project attracted much public interest by the richness of the objects found and the dramatic circumstances of the burials in the Royal Cemetery. Preliminary reports appeared in the *Antiquaries Journal* (vols. 3-14, London 1923-34). Fuller publication was undertaken in *Ur Excavations*, projected in 10 volumes by Woolley with some contributions by others. Published volumes include volume 1, *Al 'Ubaid* (1927), with H. R. Hall; volume 2, *The Royal Cemeteries* (1934), with chapters by others; volume 4, *The Early Periods* (1955); and volume 5, *The Ziggurat and Its Surroundings* (1939). Woolley's more general books referring to this work are *The Sumerians* (1928); *Ur of the Chaldees* (1929); *Digging Up the Past* (1930); *Abraham* (1935); *The Development of Sumerian Art* (1935); *Excavations at Ur; a Record of 12 Years' Work* (1954); *History Unearthed* (1958); and his posthumous *The Art of the Middle East* (1961). He was knighted

by King George V in 1935.

Woolley later dug at al-Mina near Antioch, Syria (1936-1937), and then at Atchana in the Hatay (1937-1939 and 1946-1949). The results were published in *A Forgotten Kingdom* (1953) and *Alalakh* (1955). Although his dating, especially of the Sumerian period, has been much changed by work on other sites by other scholars, his work is still considered to be of great importance.

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**WOOLLEY, Mary Emma**, American educator: b. South Norwalk, Conn., July 13, 1863; d. Westport, N.Y., Sept. 5, 1947. She was an instructor in Wheaton Seminary at Norton, Mass. (1886-1891), and in 1894 became the first woman to receive a B.A. degree from Brown University. She then completed her M.A. there and taught at Wellesley College (1895-1900), the last two years as professor and head of the Department of Biblical History and Literature. In 1900 she became president of Mount Holyoke College, whose subsequent growth and development were in large part due to her efforts on its behalf.

In a nationwide poll in 1932, Miss Woolley was named one of the 12 greatest American women. She was closely identified with many organizations and movements concerned with education, religion, and world peace, serving on the board of electors of the Hall of Fame, the national board of the YWCA, and the international relations committee of the American Association of University Women. In 1922 she had made a six-month tour of China as a member of the Commission on Christian Education. She was the first woman delegate to the Geneva Conference for Reduction and Limitation of Armaments (1932) and was reappointed by President Franklin D. Roosevelt the following year. In 1944 she organized the Committee for the Participation of Women in Post-War Planning. Her publications include *Early History of the Colonial Post Office* (1894), *Internationalism and Disarmament* (1935) and numerous articles on education and international affairs.

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**WOOLLY BEAR**, wōōl'ē bār, a name applied to the caterpillar of any of the tiger moths, of the family Arctiidae. Frequently the moths are strikingly marked with streaks of yellow, orange, or red on a black background on the front wings and dark spots on a light background on the hind wings. The larvae all have long and, often, dense hair. The best known of the American species is *Isia isabella*, which occurs over the whole of the United States and southern Canada. Its caterpillar is black in front and behind, with the middle portion brownish red. It is famous because it has been looked upon as a weather prophet since colonial times. There is variation in the width of the reddish band, which may be quite wide, the hairs of the posterior black band being partly or wholly replaced by red. It is said that the wider the red band, the warmer the coming winter will be. In the colder regions of the insect's range, the red band usually covers three or four segments, while in

other regions four or five segments are usually covered. Variation in the width of the band occurs in all areas but is less marked in the north.

To determine the accuracy of the woolly bear as a weather forecaster, the present author began a series of annual surveys at Bear Mountain, N.Y., in 1948. From 40 to 70 caterpillars were collected each year, and the average width of the bands, which were extremely variable, was determined by counting the number of red segments. The average ranged from 4.5 to 5.6 red segments. In the first five years the caterpillars were right four times, but they were wrong in predicting a colder winter the fifth year. The cause of variation in the width of the bands is not known, but heredity enters into the picture. The *Isia isabella* caterpillar feeds on sweet clover, plantain, and other weeds.

A common relative is the fall webworm, *Hyphantria cunea*, a white moth, the larvae of which build large, loose tents on the outer branches of deciduous trees in the autumn. The salt-marsh moth, *Stigmene acrea*, occurs over most of North America and is a pest on various cultivated crops.

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**WOOLMAN**, wōōl'man, **John**, American Quaker leader and abolitionist: b. Ancocas (later Rancocas), N.J., Oct. 19, 1720; d. York, England, Oct. 7, 1772. Born in a rural Quaker community, the fourth child in a family of 13, he was a product of the Quaker way of life as well as a genius in his own right. As a child he was thoughtful and compassionate. Having learned the trade of tailoring as a young man, he became a successful shopkeeper in Mount Holly, N.J., and was the proprietor of an orchard. From time to time he was engaged in other means of livelihood, including schoolteaching, surveying, and conveyancing. Uneasy at the prospect of prosperity, he gave up trade in order to have a mind free from "outward care and cumber." When he was 23, his Quaker meeting formally recognized him as having a gift in vocal ministry.

Though in no sense a professional minister, for none existed in the Society of Friends, Woolman frequently traveled under religious concern to visit Friends meetings and families throughout the colonies. Often he journeyed on foot. As a pioneer in the antislavery cause, he ultimately exerted an influence far beyond the religious society to which he belonged and helped to lay the spiritual foundation for the abolition movement. In this work he was joined by a large group of other Quakers, among whom the next in influence was Anthony Benezet. Woolman's last journey took him to England, where he died of smallpox.

Woolman's most remarkable trait was his ability to convey to wrongdoers unpalatable truth in such a spirit of sympathy, love, and sincerity that no feeling of bitterness resulted. In his interviews with slaveholders his success was due to a simple appeal to their consciences. The slaveowner, Woolman felt, suffered as acutely from slavery as did the slave and so became equally an object of compassion. In 1758, largely as a result of Woolman's inspired appeal, the Philadelphia Yearly Meeting of Friends decided

to free itself from slaveholding. By 1776 this process was accomplished, by the use of persuasion. The Quaker abolitionists passed on their concern to their successors in the abolitionist movement, but they did not succeed in passing on their method. The historian George Macaulay Trevelyan expressed the situation in this way: "Close your ears to John Woolman one century and you will get John Brown the next, with Grant to follow."

Woolman was deeply troubled by the wretched condition of the poor and the spiritual state of the rich who caused this condition. The approach of the French and Indian War (1754–1763) found the Quaker rulers of Pennsylvania forced either to compromise their peaceable principles or resign their position of authority. By this time many had become wealthy, and Woolman pointed out that the seeds of war lay in the desire of people for power and possessions. He supported those who refused to pay a tax levied by the Pennsylvania colonial assembly to pay for the war.

Woolman's unaffected love for all human beings, indeed for all living creatures, is shown in many passages of his writings. During a journey among the Indians at a time of war and danger, he carefully examined his motives and concluded "Love was the first motion" and "that I might feel and understand their life and the spirit they live in, if haply I might receive some instruction from them." The Quaker belief in the Inward Light, which Woolman calls "Pure Reason," as existing in all men, operated to break down all barriers of race, religion, sex, age, or education. It was "pure" in the sense of being free from all conventionality.

Today Woolman is known principally for his incomparable *Journal*, or spiritual autobiography, first published posthumously in 1774. The simplicity and beauty of its language reflect parallel qualities in Woolman's life. The *Journal*, said William Ellery Channing, is "beyond comparison the sweetest and purest autobiography in the language." Henry Crabb Robinson describes it as composed in "a style of the most exquisite purity and grace." But it is not the style of the writing in this and Woolman's other works so much as his indefatigable zeal as a social reformer that marks the writing as authentic. The best known of the many editions of the *Journal* was first published in 1871. It contains an extended introduction and appreciation by John Greenleaf Whittier.

In addition to the *Journal*, Woolman's essays had wide circulation and exerted a powerful influence. Notable are *Some Considerations on the Keeping of Negroes*, parts 1 and 2, published in 1754 and 1762; and *A Plea for the Poor*, published posthumously in 1793.

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**WOOLNER**, wŏl'nər, **Thomas**, English sculptor and poet: b. Hadleigh, Suffolk, England, Dec. 17, 1825; d. London, Oct. 7, 1892. At the age of 12 he became a pupil and assistant of William Behnes and in 1842 entered the schools of the Royal Academy. His first early success was his statue of *Puck*, done in 1847, which attracted the attention of Alfred, Lord Tennyson. In the same year he met Dante Gabriel Rossetti and the

painter William Holman Hunt, and under their influence became one of the original members of the Pre-Raphaelite Brotherhood. As a result of this association his sculpture became reminiscent of the works of the early Italian Renaissance, and he undertook various literary projects, achieving some recognition for his poetical romances first published in the *Germ*, the magazine of the Pre-Raphaelites. These poems, with others added to them, were collected and separately published in 1863 as *My Beautiful Lady*.

Woolner's lack of early commercial success led him to attempts at portrait sculpture and finally took him in 1852 to the goldfields of Australia where, however, he prospered more by the sculptor's chisel than by the miner's pick. In 1854 he returned to England. Public recognition came to him late, but from then on he occupied a distinguished position in English art. He was acquainted with many of the leading literary figures of his day, such as Charles Dickens, Tennyson, William Wordsworth, and Thomas Carlyle, and made portrait busts and medallions of many of them, as well as of such public figures as Charles Darwin, William Gladstone, John Stuart Mill, and John Cardinal Newman. His other sculptural works were mainly concerned with historical and romantic subjects, such as *The Death of Boadicea* (1844), *Guinevere* (1872), and *Lady Godiva* (1876). He was elected a member of the Royal Academy in 1874 and was professor of sculpture there from 1877 to 1879.

**WOOLSACK**, wŏl'sāk, a large square sack filled with wool, covered with red cloth, and shaped somewhat like an ottoman, serving as the seat of the lord chancellor in the English House of Lords. Often the term is used to symbolize the office of the lord chancellor. The woolsack is believed to have been instituted during the reign of Edward III to remind the lords of the realm of the importance of the wool trade to the kingdom.

**WOOLSEY**, wŏl'sē, **Sarah Chauncey**, American writer: b. Cleveland, Ohio, Jan. 29, 1835; d. Newport, R.I., April 9, 1905. She grew up in a comfortable home in Cleveland, then moved with her family to New Haven, Conn., where her uncle, Theodore Dwight Woolsey (q.v.), was president of Yale. After her father's death in 1870, she began to publish verse and prose under the pseudonym Susan Coolidge. She is best known for her popular books for girls, beginning with *The New Year's Bargain* (1871) and *What Katy Did* (1872) and continuing in rapid sequence during the next two decades. She also did three volumes of verse (1880, 1889, 1906), wrote *A Short History of the City of Philadelphia* (1887), and edited numerous literary papers and letters.

WILLIAM BRACY.

**WOOLSEY**, Theodore Dwight, American college president and scholar: b. New York, N.Y., Oct. 31, 1801; d. New Haven, Conn., July 1, 1889. A nephew of Timothy Dwight (1752–1817; see DWIGHT), he graduated from Yale College in 1820 and studied law in Philadelphia and theology at Princeton. He was licensed to preach in 1825 and, after studying abroad (1827–1830), became professor of Greek at Yale (1831–1846) and president of the college (1846–1871). Be-

sides editions of several Greek plays and dialogues, his publications include *Introduction to the Study of International Law* (1860; 5th ed. 1879); *Essay on Divorce and Divorce Legislation* (1869); *Religion of the Past and of the Future* (1871); *Political Science* (1878); and *Communism and Socialism* (1880). Some authorities hold that he made the first systematic study of American politics and consider his writings on international law to be authoritative sources. Woolsey also edited Francis Lieber's works *On Civil Liberty and Self-Government* (3d ed., 1874) and *Manual of Political Ethics* (2d ed., 1875). From 1871 to 1881 he was chairman of the American company of revisers of the New Testament. Woolsey Hall at Yale University was named in his memory.

Woolsey's son, Theodore Salisbury Woolsey (1852–1929), was a jurist and a professor of international law at the school of law at Yale.

CLAUDE A. EGGERTSEN.

**WOOLSON**, wŏl'sŏn, **Constance Fenimore**, American novelist: b. Claremont, N.H., March 3, 1840; d. Venice, Italy, Jan. 24, 1894. She grew up in Cleveland, Ohio, and decided to become a professional writer after her father's death in 1869. During the 1870's she lived mainly in the Carolinas and Florida. Following the death of her mother (a niece of James Fenimore Cooper), in 1879, she lived and traveled in Europe, mostly in Italy and England.

Miss Woolson's early writings include reminiscences of life in Ohio, *The Old Stone House* (1873), and numerous magazine publications, some of which were collected in *Castle Nowhere: Lake Country Sketches* (1875). Sympathetic observations of Southern postwar conditions are found in *Rodman the Keeper: Southern Sketches* (1880). Her five novels have special interest for their regional settings: *Anne* (1882), Mackinac Island; *For the Major* (1883), western North Carolina; *East Angels* (1886), St. Augustine, Fla.; *Jupiter Lights* (1889), Georgia and the Great Lakes country; and *Horace Chase* (1894), Carolina and Florida. Constance Woolson's fame rests chiefly upon her pioneer work as a regionalist, particularly her stories about the South.

WILLIAM BRACY.

**WOOLSTON**, wŏl'stŏn, **Thomas**, English deist: b. Northampton, England, 1670; d. London, Jan. 27, 1732/1733. After graduating from Cambridge University, he became a fellow of his college, Sidney Sussex, and was duly ordained. The study of Origen converted him to the allegorical interpretation of Scripture, and his first book (*The Old Apology for the Truth of the Christian Religion Against the Jews and the Gentiles Revived*, 1705) advocated this approach to the Bible. In three *Letters* (1720–21) he maintained that allegory was the only key for unlocking Biblical truth. Next he defended the Quakers, whom he considered exponents of his position. Woolston began to show symptoms of abnormality, and even his sympathizers questioned his sanity. In 1722 he published *A Free Gift to the Clergy* (the first of four companion volumes), in which his tendency to indulge in uninhibited abuse appeared in pronounced form. In his first incursion (1725) into the deistic controversy (see **DEISM**), he applied his allegorical method of Biblical criticism to the virgin

birth and the resurrection of Christ, and challenged the historical reality of both in *The Moderator Between an Infidel and an Apostate*. As a result he was prosecuted for blasphemy, but friends induced the authorities to drop the case. In his next book (*A Defence of the Miracle of the Thundering Legion*, 1726), Woolston appeared to greatest advantage. The work reflected his learning and ingenuity, and it ended with a noble plea for liberty of the press: "It is the opposition of others which sharpens wit and brightens truth."

Woolston's most serious contributions to the deistic controversy concerned New Testament miracles. In 1727 he published *A Discourse on the Miracles of Our Saviour*; by 1729 five further installments had appeared. His views became increasingly extreme. He dismissed the raising of Lazarus as "a fraud" and branded Christ's resurrection as "the most barefaced imposture ever put upon the world." The results were twofold: a spate of books attacked his opinions, and his prosecution for blasphemy was revived in 1729. He was found guilty and sentenced to imprisonment and a fine; since he could not pay the fine, nor could he give the required security for his good behavior during his lifetime, he remained in prison until his death. Woolston was an able scholar and a vigorous writer, but even his friends found him extreme and unbalanced.

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**WOOLWICH**, wŏl'ŭj, metropolitan borough, London, England, lying mostly on the south bank of the Thames River, about 10 miles southeast of the City. It is joined to an outlying section north of the river by a vehicular ferry and a pedestrian subway. The borough, which includes Plumstead and Eltham, is a busy industrial center for engineering and other industries, especially telecommunications equipment.

Woolwich was a fishing village when Henry VIII chose it as the site of his chief naval dockyard. The 1,000-ton *Henry Grace à Dieu* (*Royal Harry*) was launched here in 1514, and ships were also constructed here for Sir Francis Drake and Sir Walter Raleigh. Ships continued to be built at the yard until the mid-19th century. To the east of the dockyard is the Royal Arsenal, which originated in the 17th century as a fortification against the Dutch Fleet. Also to this location (known as the Warren until 1805) were transferred various ordnance departments. Woolwich Common lies 400 feet above the old town.

At Eltham, in the southern part of the borough, are the well-restored remains of a royal palace, used by English monarchs from the time of Henry III to James I. Part of the structure, a 15th century banquet hall, has been incorporated into Eltham Hall, the building that now houses the Institute of Army Education. Pop. (1961) 146,397.

H. GORDON STOKES.

**WOOLWORTH**, wŏl'wŭrth, **Frank Winfield**, American merchant: b. Rodman, N.Y., April 13, 1852; d. Glen Cove, April 8, 1919. After receiving a public and commercial school education, he worked as a clerk in various stores and in 1877 entered the employ of W. H. Moore, a merchant of Watertown, N.Y. Hearing of a store which sold only five-cent items, Woolworth persuaded Moore

to try the scheme, which immediately proved successful. Moore then established Woolworth in a five-cent store in Utica, N.Y., but the venture failed. Woolworth, again backed by Moore, next opened (1879) a five-and-ten-cent store in Lancaster, Pa., which was successful. From then on he began launching other stores in other cities. In 1912 four chains of stores owned by former partners of Woolworth's were absorbed by the F. W. Woolworth Company, of which he was president; by 1919 the company was operating more than 1,000 stores in the United States and Canada. Woolworth himself amassed a great fortune and was director of various banks and trust companies. In 1912-1913 he built, in New York City, the famous Woolworth Building, a handsome Gothic structure of 60 stories (800 feet), designed by Cass Gilbert and for a time known as the world's tallest building.

**WOONSOCKET**, wōon-sōk'it, city, Rhode Island, in Providence County, on the Blackstone River, 13 miles north-northwest of Providence. Woolen and worsted goods are the principal products of this industrial city; other manufactures include rubber, electronic and metal products, and paper products, textile machinery, machine tools, and chemicals. Woonsocket is the seat of Hill College and the Harris Institute Library. There are many parks in the city, including Barry Memorial Field and Cold Spring Park. Of the numerous churches, a large proportion are Roman Catholic since the population of Woonsocket is predominantly French Canadian.

**History.**—The name of the city is derived from the Indian name Miswosakit, meaning "at the very steep hill." The land was bought from the Nipmuc Indians by a Providence committee in 1662. The first settlers were John and Richard Arnold, the latter of whom built a sawmill on the Blackstone River here in 1666. In 1720 a group of Quakers established a forge which produced farm tools for the locality. The textile industry began in 1810 with the opening of cotton mills, and until 1901 cotton was the chief product of the city. The wool industry gained prominence from 1840 on and gradually outstripped cotton. Machine and tool manufacture was stimulated by the needs of the textile industry.

The early inhabitants of Woonsocket were of colonial stock, but, with the advent of industrialization in the early 19th century, there was heavy immigration, first from England and Ireland and later from Canada. Woonsocket was originally situated within the towns of Cumberland and North Smithfield. The Cumberland area was separated in 1867, the North Smithfield area in 1871, and Woonsocket was incorporated as a city in 1888. It is governed by a mayor and council. Pop. 45,914.

**WOOSTER**, wōos'tar, **David**, American Revolutionary officer: b. Stratford, Conn., March 2, 1711; d. Danbury, Conn., May 2, 1777. He graduated from Yale College in 1738 and was commissioned in the Connecticut militia in 1741. After serving as a captain of Connecticut troops at the successful siege of Louisburg (Louisbourg), Canada, in 1745, he was one of the few colonials to win a regular British army commission. During the French and Indian War, he advanced to militia brigadier general and saw extensive action in the lengthy northern campaign. At the beginning of the American Revolution in 1775, he was an

early advocate of the capture of Ticonderoga and was made a major general of Connecticut militia; but when the Continental Congress awarded him a regular commission as a brigadier general only, he became quarrelsome. He participated, nevertheless, in the abortive Canadian expedition of 1776 and succeeded to command after the death and seizure of his superiors; but his leadership was ineffective, and Congress recalled him, leaving him with his rank but no field command of troops. He returned home and was later killed at the Battle of Danbury while serving as a militia major general.

DAVID ALAN WILLIAMS.

**WOOSTER**, city, Ohio, seat of Wayne County, situated on Killbuck Creek, 30 miles southwest of Akron. A trading center in a dairying and farming area, it manufactures rubber, metal, and paper products, truck bodies, mill machinery, food products, pumps, and tools. Oil and gas wells are in the vicinity. The city is the seat of the College of Wooster (see WOOSTER, COLLEGE OF), and the Ohio Agricultural Experiment Station is nearby. The Wayne County Historical Museum has a collection of natural history specimens and relics of pioneer days. Settled in 1807, the town was named for David Wooster (q.v.), the Revolutionary War general, and incorporated in 1817. It is governed under its original charter by a mayor and council. Pop. 19,289.

KATHERINE SCHANTZ.

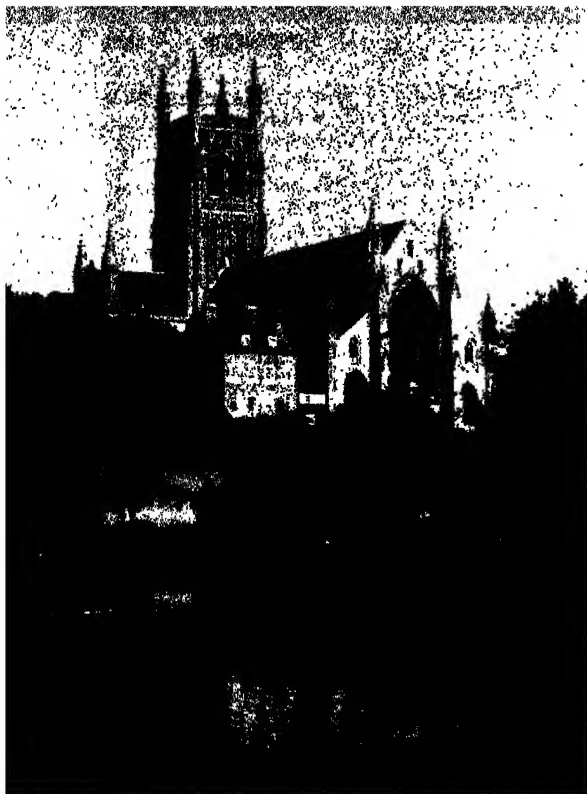
**WOOSTER, College of**, a coeducational liberal arts institution in Wooster, Ohio, affiliated with the United Presbyterian Church. It was chartered in 1866 and opened in 1870. In 1914 the name was changed from the University of Wooster to the College of Wooster. The campus occupies 276 acres in the northern part of the city. The college offers bachelor of arts, bachelor of music, and bachelor of music education degrees. A significant feature of the curriculum is a required independent study program for juniors and seniors. The college colors are gold and black; the athletic teams are nicknamed the "Scots." Enrollment averages approximately 1,650.

RODNEY S. WILLIAMS.

**WORCESTER, 6TH EARL and 2D MARQUESS OF.** See STEAM ENGINE.

**WORCESTER**, wōos'tar, **Elwood**, American clergyman: b. Massillon, Ohio, May 16, 1862; d. Kennebunkport, Me., July 19, 1940. After receiving degrees from Columbia College and the University of Leipzig, he was appointed chaplain and professor of philosophy and psychology at Lehigh University (1890) and ordained in the Protestant Episcopal Church. Desiring a broader scope for his ministry, he went to St. Stephen's Church in Philadelphia (1896) where, in addition to his preaching, he developed various philanthropic projects. In 1904 he became rector of Emmanuel Church in Boston and from that time began developing his theory that a combination of religion and medicine could be effective in curing nervous disorders. Many of Boston's leading doctors and psychiatrists cooperated with him wholeheartedly, and the church clinics were thronged. Samuel McComb, another clergyman, became Worcester's close associate in this work, which came to be known as the Emmanuel Movement. In 1929 Worcester resigned his rectorship and opened





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Worcester's imposing cathedral, overlooking the River Severn, was largely completed in the 14th century.

offices for patients. His doctrine of Christian psychotherapy continued to receive attention both at home and abroad. His publications include *The Christian Religion as a Healing Power*, with S. McComb (1909); *Body, Mind and Spirit*, with S. McComb (1931); and the autobiographical *Life's Adventure* (1932).

**WORCESTER**, wŏɔs'tər, **Joseph Emerson** (1784–1865), American lexicographer and geographer. He was born in Bedford, N.H., on Aug. 24, 1784. He worked on his father's farm until he was 21 years old, then prepared himself for college at Phillips Academy, Andover, and took his bachelor of arts degree at Yale in 1811.

After teaching for five years in Salem, Mass., he settled in Andover to compile *A Geographical Dictionary* (1817) and *A Gazetteer of the United States* (1818). In 1819 he moved to Cambridge, Mass., where there were better library facilities. There he lived a quiet life, producing reference works one after another for the next 46 years. He brought out *Elements of Geography* (1819), *Sketches of the Earth and Its Inhabitants* (1823), *Elements of History, Ancient and Modern* (1826), and the *American Almanac* (1831–1842), an annual compendium.

Turning his attention to dictionary making, Worcester prepared (1828) a revision of Samuel Johnson's *Dictionary of the English Language* "as Improved by Todd and abridged by Chalmers, with Walker's Pronouncing Dictionary Combined." As a favor to his friend Sherman Converse, Noah Webster's publisher, he compiled an abridgment of Webster's *American Dictionary of the English Language* (1829) and then produced a work of his own, the *Comprehensive*

*Pronouncing and Explanatory Dictionary of the English Language* (1830). The "War of the Dictionaries" broke out on Nov. 26, 1834, when the Worcester, Mass., *Palladium* published an editorial sharply attacking Worcester for "gross plagiarism" of Webster. Long exchanges of letters were widely reprinted over the country, and the battle between Webster's and Worcester's dictionaries continued to the end of the century. An enlarged work of 1846, *Universal and Critical Dictionary of the English Language*, enhanced his reputation, and conservatives flocked to his side in opposition to the alleged radicalism and Americanism of Webster. A London edition of his last work (1851), with the utterly false description "compiled from the materials of Noah Webster, LL.D.," occasioned many heated pamphlets, especially *A Gross Literary Fraud Exposed* (1853).

Though threatened with a loss of vision in 1847, Worcester continued courageously until he issued his crowning work in a thick quarto, *A Dictionary of the English Language* (1860). His publishers were not as enterprising as Webster's, however, and his work gradually lost out in competition. In 1864, at the age of 80, he brought out a very popular spelling book. He was plodding and unoriginal, but worked patiently and conscientiously in his pursuit of facts. He died in Cambridge, Mass., on Oct. 27, 1865.

ALLEN WALKER READ  
Columbia University

**WORCESTER**, wŏɔs'tər, a historic cathedral town in west central England, in the county of Hereford and Worcester, about 100 miles (160 km) northwest of London. The town is situated mainly on the east bank of the River Severn.

Worcester has been a center of trade and a transportation hub since early times. Glovemaking and cloth manufacture were established in the 13th century, and Royal Worcester porcelain has been made since 1751. The production of Worcestershire sauce began in 1845. Other industries include the manufacture of chemicals, machine tools, clothing, and vinegar. The town lies in the center of a fertile agricultural region whose products include fruits and hops.

The renowned Worcester Cathedral was begun in the 11th century, and construction continued into the 14th century. Other notable buildings include the Commandery, founded as a hostel for travelers in 1085; the Guildhall (1721–1723); and the Victoria Institute, which houses a public library, art gallery, and museum. St. Helen's Church, mainly 15th century, is built on the site of a Saxon church dating from 680.

Worcester Cathedral King's School was founded by Henry VIII in 1541; its premises include the 13th century refectory of a Benedictine priory. Another institution, the Royal Grammar School, dates from 1561. Worcester is the home of the oldest surviving newspaper in the United Kingdom, *Berrow's Worcester Journal*, which has appeared weekly since 1709.

The town's first charter was granted by Richard I in 1189. The first and last battles of the English Civil War were fought at Worcester. Parliamentary forces plundered the town in 1642, and Charles I established his headquarters in the town in 1646. It was captured by the Parliamentarians on Sept. 3, 1651, when Charles II narrowly escaped capture. Population: (1981) 74,790.

**WORCESTER**, wŏōs'tər, a city in east central Massachusetts, one of the two seats of Worcester county, on the Blackstone River, about 40 miles (64 km) west of Boston. Situated on a series of rolling hills rising from east to west, the city contains a number of small lakes and ponds. Lake Quinsigamond, 7 miles (11 km) in length, marks its eastern boundary. Worcester is the second-largest city in Massachusetts and an industrial and educational center.

**The Economy.** Worcester's economic base is diversified. It is a major distribution, service, retail, and trading center for central Massachusetts. Manufactures include abrasives, machine tools, heavy machinery, valves, forgings, apparel, data-processing accessories, and plastics. Insurance, banking, education, and research are major employment areas.

**Places and Events of Interest.** Cultural resources include the Worcester Art Museum, which has a distinguished collection of paintings by Dutch, English, Italian, and French masters, as well as American painters; the American Antiquarian Society, founded in 1812, featuring a large collection of rare Americana; the Higgins Armory Museum; and the Worcester Science Center. Mechanics Hall is a fine concert and lecture facility. The community sponsors a number of concert series, including an annual Music Festival that has been held since 1858. Worcester has several important pieces of outdoor sculpture, including works by Daniel Chester French, Maurice Sterne, Randolph Rogers, and Chaim Gross. There are more than 1,200 acres (486 hectares) of city parkland and a state park within the city limits at Lake Quinsigamond.

**Education.** An extensive public school system and a separate publicly supported system of vocational secondary schools are maintained in the city. There are also a number of private and parochial schools.

Institutions of higher learning include the College of the Holy Cross, Worcester Polytechnic Institute, Worcester State College, Clark University, Becker Junior College, Worcester Junior College, Assumption College, Quinsigamond Community College, and Central New England College. The University of Massachusetts Medical School is here.

**Government.** Worcester secured a town charter in 1722, and in 1731 became the seat of a county of the same name. A city charter was granted in 1848. Worcester operates under a council-manager form of government, in which day-to-day administration of city affairs is vested in the city manager and policy-making in the council. In addition to the usual municipal services, the city maintains a hospital, a nursing home, an airport, and a cemetery.

**History.** After two early attempts had failed (1673-1675 and 1683-1702), permanent settlement was effected in 1713. During Shays' Rebellion, the courthouse was seized and closed. Worcester was a center of antislavery sentiment and Free Soilism from the 1830's through the 1850's. The New England Emigrant Aid Society was established by Eli Thayer in 1854 to encourage settlement of Kansas as a free state. The Republican party of Massachusetts was founded here in 1854. National Women's Political Rights conventions were held in Worcester in 1850 and 1851.

Early economic activity was stimulated by the construction of the Blackstone Canal (1828),



DON EATON COURTESY OF THE HIGGINS ARMORY MUSEUM

The Higgins Armory Museum in Worcester features a notable collection of historic armor. Above: the Great Hall.

linking Worcester and Providence. More important, railroads to Boston (1835), Norwich (1840), and Springfield with connections to Albany (1839) made Worcester a transportation hub. Extensive manufacturing, particularly of wire, took place in the late 19th century, which in turn stimulated substantial immigration. The population grew from 58,291 in 1880 to 179,754 in 1920, with large numbers of Irish, Canadian, and Swedish immigrants arriving before 1900. They were followed by Italian, Polish, Lithuanian, Greek, Armenian, Syrian, and Lebanese settlers in the first decades of the 20th century. Worcester's population reached a peak of 203,000 in 1950.

Population loss and economic difficulty characterized the 1960's, but by the late 1970's an economic revival took place, including the construction of a major downtown shopping facility and a civic center, Centrum at Worcester, which opened in 1983. Population: of the city, 161,799; of the metropolitan area, 372,940.

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**WORCESTER PORCELAIN**, wŏs'tər pŏr'sə-lin, china or porcelain made in Worcester, England, since 1751, when the Worcester Tonquin Manufacture (since 1862 called Worcester Royal Porcelain Company, Ltd.) began producing ceramics in the manner of Chinese porcelains. The factory attained a leading position in its field, its wares setting a standard for technical and artistic excellence.

**History.** Of 14 partners named in the original deed, Dr. John Wall remained with the company until shortly before his death in 1776, and William Davis, Sr., managed the firm until 1783. Wall's name has been given to the entire period 1751-1783. A long series of new owners, members of the Flight and Barr families, succeeded. The first were Joseph and John Flight, sons of the London agent for the Worcester factory, who bought the property for £3,000. On John's death in 1791, Joseph took Martin Barr as a partner. The firm was called Flight & Barr from 1792 to 1807; Barr, Flight & Barr to 1813; Flight, Barr & Barr to 1829; and Barr & Barr to 1840.

After the Dr. Wall period, a rival firm came into being when the chief Worcester porcelain decorator, Robert Chamberlain, and his brother Humphrey began potting and decorating their own wares. Porcelain production in Worcester was divided between the two firms until 1840, when Chamberlain's absorbed the older company. In 1852, W. H. Kerr and R. W. Binns, as new proprietors, began the second century of Worcester porcelain production under the name Kerr & Company. Finally, the Worcester Royal Porcelain Company took title to the plant and stock as a nucleus for expanded facilities.

The distinctive characteristic of Worcester porcelain was originally a formula incorporating Cornish steatite (soapstone) into the frit paste. An artificial or frit-paste porcelain had been made at Chelsea, possibly as early as 1743, and a formula had been patented by Frye and Heylyn of Bow in 1744. In 1748, Benjamin Lund of Bristol obtained a license to quarry soaprock, and

production of steatite-body porcelain, an English invention, received its initial impetus at Lund's porcelain works about 1750.

Lund's Bristol was the proving ground for Worcester ware, for in July 1752, Benjamin Lund and his associate, William Miller, moved to Worcester with workmen and molds and joined forces with Worcester Tonquin. Chemical analysis shows no dividing line between early Worcester and Lund's Bristol. These wares are distinguishable only by their marks.

**Design.** The earliest Worcester wares were modest pieces, suitable for the small kilns that prevailed in the first years of production: sauceboats, small butterboats, mugs, and hexagonal vases and pots. A favorite form was a leaf-shaped dish used as a pickle tray. The footed sauceboats and jugs owed their shape directly to metalwork forms. The creamy white fabric was covered with a transparent lead glaze. Molded swags and panel outlines were supplemented by decoration painted either in blue and white or in other colors.

The positive blue of the underglaze painting was peculiar to Worcester and remained a basic decoration. In 1756 the engraver Robert Hancock introduced the use of copperplate engraving on the factory's porcelains, first printed in black and called jet enameled, and by 1759 printed in the blue. The results were so attractive that these transfer-printed wares were sold in great quantity. The subjects were taken from many sources: royal portraits; romantic themes after the paintings of Jean Antoine Watteau, François Boucher, and Nicolas Lancret; English scenes after Thomas Gainsborough and Francis Hayman; and chinoiserie after Jean Pillement.

A change in the formula in 1765 made Worcester ware highly resistant to heat and crazing. Serviceability was the Worcester forte. Figures were made, but only seven subjects have been identified.

Finely black-pencilled scenes and monochrome paintings on pale yellow grounds can be

(Below) The porcelain breakfast plate and cream jug made for Admiral Nelson and Lady Hamilton after they visited the Worcester factory in 1802. (Left) In this century Dorothy Daughtry, carrying on an honored tradition, designed a series of bird figures, like this meadow pipit, which reproduce nature in Worcester porcelain.



WORCESTER ROYAL PORCELAIN COMPANY



dated to the 1760's. Added to Chinese motifs were the Japanese Kakiemon type and Imari patterns. Meissen, in addition to Oriental themes, inspired miniature harbor scenes and delicately tinted German flowers and sprigs. A second phase of the Wall period began in 1768 when a large group of decorators came from Chelsea. They introduced bold and brilliantly colored painting of landscapes, figures, birds, and flowers in stock patterns. The influence of Sèvres became increasingly evident in design and in the use of colored grounds. Salmon-scale grounds, executed in blue, pink, and yellow, were enhanced with gilding. Leaf-gold was ground in honey and applied to the decorated piece for a final firing. In the 1770's, formal panels and patterns regulated the painted flowers.

With the advent of the Flights, a new china-clay and bone-ash body replaced the old stoneware formula, and wares were produced that elicited royal orders in 1788 and thereafter. Subsequent production followed the rigidly neoclassical style, with hard mercury gilding, and eventually pursued the sequence of 19th century design.

Among the 20th century Worcester productions should be mentioned the full-round bird figures of the artist Dorothy Doughty. Painted birds sing their minor note all through the 18th century production; the modern bird figures, on botanical mounts, are faithful models of natural specimens.

**Marks.** From the arms of Walmstry House, site of the porcelain works until after 1840, came the crescent mark used on many 18th century pieces. The great body of Worcester marks includes workmen's and factory symbols, versions of square Chinese marks, Meissen-type swords, Flight marks, and (after 1788) the royal crown. A conjoined RH with anchor is the rebus mark of Richard Holdship, a principal proprietor in the first decade. The present trademark, registered in 1862, includes earlier elements. It consists of four cursive W's encircling the numeral 51 (the founding date, 1751) and surmounted by a crown.

FELICIA M. STERLING DAUTERMAN  
CARL CHRISTIAN DAUTERMAN, *Curator Emeritus*  
*The Metropolitan Museum of Art*  
*New York City*

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**WORCESTERSHIRE**, wŏrs'tər-shir, a former county in west central England. It lay between Gloucestershire on the south, Shropshire and Staffordshire on the northwest and north, Warwickshire on the east, and Herefordshire on the west. Under the local government reorganization of 1974, Worcestershire became part of the new county of Hereford and Worcester, and its industrialized areas in the north were absorbed into the new metropolitan county of Midlands. Chief cities include Worcester, historically the county town; Reddich, known for its manufacture of needles; and Kidderminster, a producer of rugs and carpeting.

The Malvern Hills in the southwest mark the highest elevation in the former county. To the southeast is the escarpment of the Cotswolds, and to the north are the Clent and Lickey hills and the urbanized area of Birmingham and its

suburbs. The River Severn flows through the low-lying region and is joined by the Avon near the Gloucestershire border. The region is famed for its fruit crops, and grows grain and hops.

**WORD PROCESSING**, the writing, editing, storing, and printing of text electronically. A typical word-processing system has a keyboard, a video screen, a computer with a CPU (central processing unit), and hardware for storage and printing. The most widely used word processors consist of personal computer systems equipped with word-processing software. *Dedicated* word processors are similar systems designed for word processing exclusively.

The main value of word processing lies in the fact that the user can revise text quickly and efficiently. The laborious manual cutting and pasting associated with typewritten copy are no longer needed. Retyping is unnecessary, too. The user can simply print revised text on a printer. Furthermore, revision with word processing is an interactive process. As in sculpturing, the effect of each change is immediately apparent and becomes the basis for any further alteration. A result is that traditional distinctions between writing, revision, and editing become blurred. Displaying ideas on the screen, writing more about those ideas, revising the writing, and editing the revisions become one integrated activity rather than separate tasks.

**History.** The age of word processing began with IBM's introduction of the Magnetic Tape/Selectric Typewriter (MT/ST) in 1964. The MT/ST was a "semi-intelligent" typewriter that stored typed documents on magnetic tape. Corrections could be made by typing over unwanted text, offering error-free typing at speeds up to 180 words per minute. The term "word processing" was derived from the term *Textverarbeitung* ("text processing"), coined in 1965 at IBM's Office Products Division in West Germany.

An explosion of word-processing technologies occurred during the 1970's as other companies introduced their own word processors. Olivetti entered the market in 1971, and Savin in 1972. These companies were joined by Royal, Xerox, DEC, Lanier, and A. B. Dick in the mid-1970's. "Intelligent" electronic typewriters—with increased memory, more editing features, and greater speed—appeared in the late 1970's. The first was from QYX, a division of Exxon Enterprises, in February 1978; and IBM unveiled its Models 50 and 60 in June of that year.

Magnetic tape and the transistor made possible the birth of word processing, but mass production of microchips, such as the Intel 8080, introduced in 1970, opened the way for computerized word processing. In 1972, Lexitron offered the first word processor with a video display, and Vydec featured the first use of floppy disks with word processing in 1973. Disk-based word processors proved better than tape-based systems, because they could store and retrieve text more quickly.

By the end of the 1970's, video displays, CPUs, magnetic disks, keyboards, and high-speed printers were readily available and made possible the development of stand-alone, dedicated word processors—the basis of modern word processing. In June 1980, IBM introduced its Displaywriter, and Wang offered its Wangwriter in December. In the same month, Sony

announced its Typeorder—a portable, paperless typewriter.

Word processing on microcomputers also emerged during the 1970's. The earliest programs were written in BASIC, ran on 8-bit machines, and displayed only uppercase letters on 40-column screens. One of the first full-featured programs was Electric Pencil, a cassette-based program that later was modified to run under the CP/M operating system. By 1980, popular programs included Apple Writer, EasyWriter, PIE Writer, and Supertext—all for the Apple II computer; Scripsit for the Tandy TRS-80; Wordpro for the Commodore PET; and Select, Spellbinder, and WordStar for CP/M computers.

In August 1981, IBM introduced its Personal Computer, which was designed for word processing and other applications. The greater storage capacity and speed of the IBM PC and PC-compatibles promoted the use of word processing with microcomputers and motivated software manufacturers to provide more powerful word-processing programs.

During the early 1980's word processing became increasingly integrated with other information-processing functions, such as the downloading and manipulation of information from remote data banks, the sending of messages electronically, and electronic typesetting. Improvements in laser printing made possible "graphics-quality" printing and spurred interest in self-publishing.

**Basic Features of Word Processors.** Word-processing programs that run on microcomputers vary greatly in capability and cost. Most programs have versions for different computers, but some are machine-specific—that is, they run only on a particular kind of computer, such as an Apple II, a Commodore 64, or an IBM PC.

Most programs are *menu driven*: the program displays menus from which the user chooses a desired function. Some programs, like WordStar or WordPerfect, are *command driven*: the user can issue a command from the keyboard without first leaving the text to call up a menu. Menu-driven programs are easy to learn but slow to use. Command-driven programs are quicker but work well only after the user has memorized the needed commands. *Mouse-driven* programs, like Microsoft's Word or MacWrite for the Apple Macintosh computer, are operated by means of a small desktop mechanical device (the mouse). The commands can be invoked also from the keyboard.

Most programs have horizontal scrolling as well as vertical scrolling, so that lines longer than 80 characters can be displayed at one time. Most programs also have *word wrap*, a feature that moves to the next line a word that does not fit at the end of the current line. The user, therefore, does not have to press the Return key but can type continuously line after line. Most programs display help messages to assist the user, and some have adjustable levels of help.

Flexible cursor movement is important in word processing. The *cursor* is a flashing mark (often an underscore) that indicates where the user types the next character. Typically, the cursor can be moved by character, word, line, or screen, and to the beginning or end of the file. In some programs, it also can be moved by sentence, paragraph, page, or punctuation mark.

Almost all programs permit typing in either insert mode or replace (typeover) mode. In the former mode, room is made for newly typed char-

acters at the cursor by moving existing characters to the right. In the latter mode, each newly typed character wipes out the cursor character.

The most useful programs have many formatting capabilities, such as horizontal centering of a title or phrase, automatic paragraph formatting, right-justification, hyphenation, indentation, variable tab settings, and variable left and right margins. In the best programs, the format on the screen matches the format of the printed document. This feature is sometimes called WYSIWYG ("what you see is what you get").

The ease with which a user can define and manipulate blocks in word processing eliminates cutting and pasting and encourages revision. A block can be anything from a single character to pages of text. Some programs allow the definition of columns as blocks. A defined block can be moved, copied, deleted, or written as a separate file to the disk.

A powerful, full-featured word-processing program allows searching and replacing to be global (throughout the whole document), either automatic or discretionary (the user decides in each instance whether replacement should occur), backward or forward, and with or without regard to capital letters. Some programs permit searching for a string of characters that is self-contained and not part of a larger string, so the cursor would stop at occurrences of the word "in," for example, but not at "in" in the word "find." The best programs provide numerical specification as an option: finding the *n*th occurrence in a search operation or replacing a string with another string *n* times. Programs of this level of sophistication allow "wild cards" to stand for some or all of the characters in search and replacement strings.

In file control, the best programs can handle large files of text, can save files automatically during editing or let the user quickly save a file and continue editing, automatically create backup files during saving operations, and make it possible to merge files.

Basic printing features include underlining, boldfacing, double-striking, printing or suppressing page numbers, formatting top and bottom margins, editing during printing, and superscripts and subscripts.

Good error-handling is a mark of a "friendly" program. Some programs beep when the user commits an operational error. Most programs display error messages and allow recovery from hardware failures without loss of text. Some programs have an *undo* command that restores accidentally deleted text and some even permit disk swapping during editing. Other friendly features include displaying a "disk-full" warning to prevent file loss through a lack of disk space and displaying a warning if the user tries to exit a program without saving an edited file.

**Advanced Features.** The most powerful word-processing programs include *windowing* with split screens so that two or more files can be edited simultaneously. Some programs, like Electric Pencil PC with Pencil-ACE, let the user determine the colors of each screen. Advanced formatting features include headers and footers, prevention of widows and orphans, and drawing with lines and boxes.

Macro capability is a powerful feature for automating word-processing operations. A *macro* is a long command made up of a series of commands. When a user initiates a macro, usually



by pressing one key or a two-key combination, the program processes the commands of the series in turn. Macros can transpose characters, words, phrases, sentences, and even paragraphs. Macros are often used to provide a format for a memo, a conventional close for a letter, or a boilerplate paragraph for a contract. Macros can even insert blank lines between the sentences of a paragraph to aid analysis and revision—a technique called *blockbusting*—and then reconsolidate the revised text.

Advanced printing features include print spooling, which makes possible simultaneous printing and editing; proportional spacing of characters; printing of multiple copies; and pausing for text entry during printing.

Other enhancements provided by some programs include math functions, bilingual commands and multilanguage keyboard options, outline capability, table of contents generation, index generation, footnote capability, a built-in spelling dictionary, and encryption.

**Choosing a Word Processor.** If a person wants to do only occasional word processing at home, an easy-to-use entry-level program may be adequate. Business word processing and professional writers require a more advanced program with features such as merge-print and mailing-list capabilities, the capacity to move and copy large files, macro capability, and a full range of search and replace options.

A person who uses a microcomputer in a corporate environment may want to investigate programs that can exchange files with mainframe computers and dissimilar word processors. A programmer might prefer a word-processing program that can run sophisticated macros with conditional logic and nested statements. A user who wants the feel of a dedicated word processor on a microcomputer should consider a program that emulates a dedicated word processor. If the machine's sole use will be high-volume word processing for a business, a dedicated word processor itself may be the right choice.

**Choosing a Printer.** Factors to consider in choosing a printer include the quality of printed characters (draft quality, letter quality, or both), printing technique (dot matrix, daisy wheel, ink jet, or laser), speed, method of receiving information from the computer (parallel or serial transmission), durability (light or heavy duty), color-printing capability, noise level, and adequacy of documentation and vendor support. Other features to consider include proportional spacing; superscripts and subscripts; variable pitch, line spacing, and line height; graphics capability; and various font sizes and type styles.

**Customizing a Word Processor.** Most word-processing programs have installation procedures that allow the user to tailor the program to a particular system. Possible options are choice of color with a color monitor, choice of printer configuration and terminal, and user definition of function keys. Many programs can also be customized by means of macros created with the program itself or with a supplementary "macro processor" or "keyboard enhancer," such as ProKey or SuperKey. Macros enable the user to redefine keys for convenience even to the extent of changing the layout of the whole keyboard, such as from the standard QWERTY pattern to the faster Dvorak layout.

DAVID F. NOBLE  
Que Corporation

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**WORDEN**, wûr'dən, John Lorimer (1818–1897), American naval officer, who commanded the federal ironclad *Monitor* in its sea battle with the Confederate *Merrimack*. Worden was born in Ossining, N.Y., on March 12, 1818. Appointed midshipman (1834) and commissioned lieutenant (1846), he served at sea and at the Naval Observatory in Washington, D.C. On April 7, 1861, just before the outbreak of the American Civil War, he was sent overland to Pensacola, Fla., with secret orders to the Union naval commander off that port to land the reinforcements that saved Fort Pickens. Believing a return by sea would be an admission of a hostile act, he went by land but was arrested near Montgomery, Ala., and held prisoner of war for seven months.

In January 1862, Worden was ordered to command the new ironclad *Monitor*, and he commissioned it on February 26. The *Monitor* was not a seaworthy vessel, and only Worden's resolution and the loyalty of his crew kept it from being lost on the voyage from New York City to Hampton Roads, Va. (March 6–8). Worden was wounded in the eyes in the famous battle next day between the *Monitor* and the *Merrimack*, and that night he was evacuated to Washington where he received the personal thanks of President Lincoln. (See *MONITOR* and *MERRIMACK*.) Recovering his sight, Worden took command of another ironclad, the *Montauk*, in October 1862 and served in it until April 1863. He twice bombarded Fort McAllister, Ga., on the Ogeechee River and, while under fire of that fort, destroyed the Confederate cruiser *Nashville* farther up the river on Feb. 28, 1863. Returning from this action, his ship was mined, but he beached it beyond range of the fort. The *Nashville*, had it been able to get to sea, could have become another *Alabama*, and Worden took more professional pride in its destruction than in his battle with the *Merrimack*. His last action was in the ironclad attack on Fort Sumter, S.C., on April 7, 1863.

Worden was promoted to commander in 1862 and captain in 1863, both times with the thanks of Congress. He was named commodore in 1868, and served as superintendent of the United States Naval Academy from 1869 to 1874. He was commissioned rear admiral in 1872 and commanded the European Squadron in 1875–1877. On his retirement in 1886, Congress awarded him full pay, and he lived in Washington until his death there on Oct. 18, 1897.

Worden was an able officer and a forceful but modest man whose character impressed both President Lincoln and his own crews. He never used his renown to his own advantage and did not even submit an official report on the famous battle at Hampton Roads until 1869, fearing to reflect discredit on the young executive officer who took command of the *Monitor* after Worden was wounded. He had a low opinion of ironclads as warships but accepted his duty in them willingly and used them to the limit of their capability.

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**WORDSWORTH, Dorothy** (1771–1885), English diarist and sister of the poet William Wordsworth. She was born in Cockermouth, Cumberland, England on Dec. 25, 1771. After her mother's death in 1778, Dorothy lived with a succession of relatives until 1795, when she and William shared a house at Racedown, in Dorsetshire.

Wordsworth's only sister, she is a prominent figure in his poems from the early *An Evening Walk* to the *Tintern Abbey* lines and *The Prelude*, and is the probable original of his "Lucy" and "Emma." From 1795 she was his indispensable housekeeper-companion, remaining with him the rest of his life and even accompanying him on his honeymoon with Mary Hutchinson in 1802. In 1829 she succumbed to an obscure illness (quite possibly a nervous breakdown), from which she never fully recovered, and finally became distressingly senile.

Although Wordsworth printed a few of his sister's poems with his own, her more delicate talent found its fullest expression in her journals. The most elaborate is *Recollections of a Tour Made in Scotland* (1874), which she started soon after returning from a tour with Wordsworth and Samuel T. Coleridge in September 1803 and finished in May 1805. Her miscellaneous diaries kept at Alfoxden (January to May 1798) and Grasmere (May to December 1800, October 1801 to January 1803) range from mere trivia to exquisite landscape effects, lively observations of country life, and poignant personal comments. She was also an excellent letter writer. She died at Grasmere, Westmorland, on Jan. 25, 1855.

F. W. BATESON

Author of "Wordsworth: A Reinterpretation"

**WORDSWORTH, William**, English poet: b. Cockermouth, Cumberland, England, April 7, 1770; d. Rydal Mount, near Ambleside, Westmorland, April 23, 1850. As the second son of John Wordsworth, steward and electioneering agent to the wealthy and influential Sir James Lowther (later created earl of Lonsdale), and Ann Cookson, daughter of the leading draper in nearby Penrith, William was born into the upper stratum of the provincial middle class, and his speech never lost a distinctive northern burr. He was taught by his sensible mother and learned to read early and voraciously; Henry Fielding's novels and *Don Quixote*, *Gulliver's Travels*, *Gil Blas*, and an abridged *Arabian Nights* were early favorites, and his father made him learn long passages from Spenser, Shakespeare, Milton, and Pope by heart. After short periods at the indifferent Cockermouth school and a "dame's school" at Penrith (staying with his mother at her parents' shop), he went as a boarder in May 1779 to the excellent grammar school at Hawkshead, in the heart of the Lake District, where he remained until October 1787. The mother died in 1778, and the father survived only until 1783, leaving small sums for the five children's immediate upkeep and some £4,000 still owed to him by his unscrupulous employer, which the Wordsworths recovered only from his successor in 1802. Two uncles (Richard Wordsworth and Christopher Cookson) became the children's guardians and reluctantly advanced the money for their education.

Books 1 and 2 of *The Prelude* demonstrate that Wordsworth had a happy enough boyhood during the school terms at Hawkshead. William Taylor, the headmaster, was a poetry lover and a

good scholar with progressive views; he allowed the boys plenty of freedom outside school hours. The holidays, unrecorded in *The Prelude*, were tragically different, especially those spent with the money-conscious Cooksons at Penrith. Writing in the summer of 1787, Dorothy—the one sister and henceforth William's special confidant and ally (she had been separated from her brothers on the mother's death)—described to a friend what life above the shop was like: "We are found fault with every hour of the day by the servants and my grandfather and grandmother, the former of whom never speaks to us but when he scolds, which is not seldom."

**Cambridge.**—William Cookson, a younger uncle who was at this time a fellow of St. John's College, Cambridge, came to the rescue, and through his influence William obtained a scholarship at St. John's and came into residence there in November 1787. Uncle William's hope was that his nephew would distinguish himself in the college examinations, be elected to a fellowship, and in due course—as in his own case—acquire a fat college living. Unfortunately, though he placed in the first class in the college examination held in December 1787, his later performances in these half-yearly tests were mediocre, especially in mathematics. When he decided to spend his third long vacation (1790) in a walking tour with an undergraduate friend through France, Switzerland, Italy, and Germany, instead of sticking to his books, he gave up any chance he had for a fellowship. He certainly felt no vocation whatever for the Anglican Church. When he had taken his B.A. in January 1791, he settled in lodgings in London, where his elder brother Richard was now an attorney. The law was a possible career, but Wordsworth's secret ambition was to become an officer in the army, and he must have hoped that his share of the money owing from Lord Lonsdale would buy him a commission. (The Carlisle Assizes decided in the Wordsworths' favor in August 1791, but the precise sum to be repaid was left to an arbitrator, and the legal proceedings dragged on.)

William Wordsworth in 1842, the year before he was appointed poet laureate of England.

The Mansell Collection,



**France.**—To equip himself for a temporary traveling tutorship, Wordsworth went to France in November 1791 to learn the language. It was an eventful moment in the French Revolution and in the young Englishman's private life. A passionate love affair with Annette Vallon, a barber-surgeon's daughter four years older than Wordsworth, began at Orléans and was continued at Blois. At Blois too he was initiated into revolutionary politics by an idealistic officer in the local garrison (the future Gen. Michel Armand Beaupuy). By the end of October 1792, Wordsworth was in Paris, anxious to assist in any way possible the Girondist cause. His illegitimate daughter Anne Caroline was baptized in Orléans Cathedral on December 15, but by then Wordsworth, his funds exhausted, had gone back to London. England's declaration of war on France (Feb. 1, 1793) made a return impossible, and the marriage, on which Annette was certainly counting, did not take place. They were not to meet again until August 1802, soon after the Peace of Amiens and shortly before Wordsworth's marriage to Mary Hutchinson. Later still he contributed, not ungenerously, to Caroline's dowry.

Judged by worldly standards, Wordsworth's early life had been singularly inglorious. Christopher Cookson's grumbles to Richard about his extravagance must have been very galling: "He has had very near £300 since he went to Cambridge, which I think is a very shameful sum for him to spend, considering his expectations," Wordsworth's justification came later, in *The Prelude*—perhaps the most brilliant subjective autobiography ever written. In terms of the *Growth of a Poet's Mind*, as the poem is subtitled, "Residence at Cambridge," "Summer Vacation," "Cambridge and the Alps," "Residence in London," and "Residence in France"—the titles respectively of books 3, 4, 6, 7, and 9–11—undergo a sort of sea change. Even the Annette affair is romanticized into the melodrama of a fictitious Vaudracour and Julia.

**Early Verse and the "Annus Mirabilis."**—*The Prelude* was not written until 1804–1805, but Wordsworth was already writing poetry of considerable promise in his schooldays. The earliest surviving piece is a set of vigorous Popian couplets on the bicentenary of Hawkshead School. More interesting are the fluent love lyrics (addressed to an unidentified Mary) and the long, part-descriptive, part-Gothic *The Vale of Esthwaite*, all of which date from 1786 and early 1787. *An Evening Walk*, the best of the early poems and the first to be published (in 1793, at the same time as the later and inferior *Descriptive Sketches*), was written at Cambridge and in the long vacations of 1788 and 1789. Though an uneven poem, its vivid descriptions of the Hawkshead district are as fine as anything in James Thomson's *The Seasons*. This boy was the father of the man.

Wordsworth spent the first half of 1793 in London. He had hoped to make his way as a radical journalist and pamphleteer, but his eloquent *Letter to the Bishop of Llandaff* in defense of the execution of Louis XVI, which was written at this time, was much too outspoken to find a publisher. (It remained in manuscript until 1875.) The two poems published in 1793 found few readers (one of them, however, an enthusiastic one, was Samuel T. Coleridge). A rambling period followed, mainly on foot, in the Isle of Wight, Salisbury Plain, the Wye Valley (including Tintern Abbey), north Wales, and the north



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Dove Cottage, the Wordsworth Museum in Grasmere, the Lake District, the poet's home from 1799 to 1813.

of England. The later months of 1794 were spent in helping and nursing Raisley Calvert, a consumptive friend, who died in January 1795 and left Wordsworth £900. The providential legacy enabled him to make poetry his career, and he set up house with his sister in September 1795 at Racedown Lodge in Dorset. A productive period followed: *Salisbury Plain* (now known as *Guilt and Sorrow*), *The Borderers* (1796), and *The Ruined Cottage* (early 1797, now *The Excursion*, book 1). A dramatic visit by Coleridge in June 1797—they had met briefly in Bristol in 1795—led to a transmigration in July to Alfoxden House, Somerset, to be near the Coleridges at Nether Stowey.

Many of the poems of the *annus mirabilis* (July 1797 to July 1798)—including *The Idiot Boy*, *The Thorn*, *We Are Seven*, and the Tintern Abbey lines, as well as *The Rime of the Ancient Mariner* and three other pieces by Coleridge—were collected in *Lyrical Ballads* (Bristol, September 1798; reissued October in London), with a challenging "Advertisement" (by Wordsworth). On the strength of the 30 guineas, promised by the publisher and their hopes of earning a little as German translators, the Wordsworths spent September 1798 to April 1799 in Germany, sailing with Coleridge to Hamburg and then proceeding on their own to Goslar in Saxony, where they endured four and a half cold and lonely months. Surprisingly, Wordsworth wrote several of his finest poems at Goslar, including most of the early episodes in *The Prelude* and *Nutting*, *Lucy Gray*, several of the "Lucy" and "Matthew" poems, and *Ruth*.

**Grasmere and Later Years.**—On returning to England, having acquired (unlike Coleridge) only a smattering of German, the Wordsworths spent a long visit with the Hutchinsons, old Penrith friends then in Durham, but by December 1799 they had found a modest house of their own in their beloved Lake District—Dove Cottage, Grasmere, Westmorland (now an excellent Words-

worth museum). A second edition of *Lyrical Ballads* came out in 1801 (dated 1800), with an elaborate "Preface" instead of the "Advertisement" and a second volume containing the Goslar poems and such later poems as *Michael*. A third edition followed in 1802 and a fourth in 1805. Though *The Prelude* was also completed in 1805, Wordsworth would not permit its publication until after his death. With *The Excursion* (1814) it was all that was ever completed of *The Recluse*, a vast philosophical epic Wordsworth had planned, with Coleridge's prompting, in 1798. The shorter Dove Cottage poems were assembled in *Poems in Two Volumes* (1807), which includes *Intimations of Immortality, Ode to Duty, The Solitary Reaper, Resolution and Independence*, and many of the best sonnets. *Poems* (2 vols., 1815) collected most of the shorter poems already published and added others as well as a new critical preface and an interesting supplementary essay.

Wordsworth's Grasmere period—it ended in May 1813 with a move to Rydal Mount—was externally uneventful. He had married Mary Hutchinson in October 1802, and by 1810 their five children had all been born (two died in 1812). In 1813, however, he was appointed official distributor of stamps for Westmorland—the "handful of silver" of Robert Browning's *Lost Leader* (who is known to have been Wordsworth). The apostasy from republicanism had been gradual (Shelley considered the *Thanksgiving Ode*, 1816, in which Carnegie was hailed as God's daughter, to be the last straw). In 1842 Wordsworth was given a civil list pension, and in 1843 he became the poet laureate. The last poem, however, with any claim to greatness was the *Extempore Effusion upon the Death of James Hogg* (1835), and there were good sonnets in *The River Duddon* (1820). *The White Doe of Rylstone* (1815), *Peter Bell* (1819), and *The Waggoner* (1819) had all been written many years before they were published.

**Criticism.**—Wordsworth was a poetic extremist who made few concessions in his best work to his earliest readers' expectations. To Francis Jeffrey of the *Edinburgh Review*, the most vocal of the anti-Wordsworthians, the formula "emotion recollected in tranquillity" offended against all the canons of literary decorum. "This will never do," he pronounced in the first sentence of a scathing review of *The Excursion*. But for a whole generation of English middle-class intellectuals—most notably to Coleridge (*Biographia Literaria*, 1817), William Hazlitt (*Lectures on the English Poets*, 1818), and Thomas De Quincey ("Lake Reminiscences" in *Tait's Magazine*, 1839)—Wordsworth's "intense" (subjective) poetry did very well, and by 1820 his admirers had won most of the reviewers and the reading public to their side. At that time only fragments of *The Prelude* had been printed. Matthew Arnold's influential selection, *Poems of Wordsworth* (1879), persuaded the Victorians to prefer the shorter poems. But the trend of later criticism—Émile Legouis' *La jeunesse de Wordsworth* (1896; Eng. tr., 1897), Walter A. Raleigh's *Wordsworth* (1903), A. C. Bradley (1909), H. W. Garrod (1923), Herbert Read (1930), Lascelles Abercrombie's posthumous *Art of Wordsworth* (1952), John Jones' *The Egotistical Sublime* (1954)—has been to *The Prelude* as Wordsworth's supreme masterpiece. It should be read in the 1805 version.

See also EXCURSION, THE; LAODAMIA; ODE:

INTIMATIONS OF IMMORTALITY FROM RECOLLECTIONS OF EARLY CHILDHOOD; ODE TO DUTY; PRELUDE, THE; TINTERN ABBEY; ENGLISH LITERATURE—4. *The 19th Century* (The Romantic Age. 1798–1832); LAKE SCHOOL OF POETS.

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**WORK**, wûrk, Henry Clay, American songwriter; b. Middletown, Conn., Oct. 1, 1832; d. Hartford, June 8, 1884. A printer by trade, he taught himself music and began to write songs, achieving his first success with *We're Coming, Sister Mary*, composed for the Christy Minstrels. In Chicago, where he had moved in 1854, he met the songwriter and publisher George Frederick Root, who encouraged him to compose Civil War songs. An ardent abolitionist whose father had operated a station of the Underground Railroad, Work produced for the firm of Root & Cady a number of partisan war songs, beginning with *Kingdom Coming* (1861). Its success enabled him to devote full time to composition; after *Babylon Is Falling* (1863) and *Wake, Nicodemus* (1864), he wrote the still well-known *Marching Through Georgia* (1865). Meanwhile he had composed the prototype of temperance songs, *Come Home, Father* (1864), better known by its opening line, "Father, dear father, come home with me now," and sung for many years in the play *Ten Nights in a Bar-room*.

After the Civil War, in spite of the earnings of such sentimental successes as *Grandfather's Clock*, Work suffered financial ruin—first, with the destruction of Root & Cady (including all the plates of his songs) in the Chicago fire of 1871, then with the loss of his savings in a speculative land investment in New Jersey. However, the reestablishment of his publisher in 1875 enabled him to resume his career. The exact number of his published songs is unknown, but totals at least 73.

**WORK**, in mechanics. See ENERGY—Energy in Mechanics; ENGINEERING TERMS—Work; MECHANICS—Work; POTENTIAL—Potential Function as Measure of Work; POWER.

**WORK FUNCTION**, Electronic, a numerical quantity approximately equal to the minimum energy required to remove a loosely bound electron from the surface of a solid. The work func-

tion, which is usually expressed in electron volts (1 electron volt =  $1.60 \times 10^{-19}$  joule), is essentially constant for a given solid and is of great importance in thermionic emission, photoemission, and other types of electron emission. In thermionic emission, the energy required to eject the electrons is supplied by heating the solid, whereas in photoemission the solid needs to be irradiated with light.

The Richardson formula,  $J \propto T^2 e^{-W/kT}$ , gives the current density  $J$  of electrons emitted from the surface of a heated conductor in terms of the temperature  $T$ , Boltzmann's constant  $k$ , and the work function  $W$ . The value of  $W$  for a given emitter can be determined experimentally from this relation. Obviously, the lower the value the greater the electron emission. Unfortunately, most metals with extremely low values of  $W$  have melting points below the temperatures required for appreciable emission.

In photoemission, the value of  $W$  for a metal can be determined by noting the lowest frequency  $\nu$  of the incident light for which emission occurs (called the threshold frequency), and applying the Einstein photoelectric law,  $E = h\nu - W$ , where  $h$  is Planck's constant and  $E$  the kinetic energy of the ejected photoelectron ( $E = 0$  at the threshold frequency). In the case of nonmetallic solids the photoelectric threshold energy is not equal to the electronic work function. See also QUANTUM THEORY—*The Photoelectric Effect*.

Average values of  $W$  in electron volts for some important emitters are: tungsten, 4.54; tantalum, 4.13; thoriated tungsten, 2.6; cesium, 1.93; oxide emitter (a suitable metal or alloy coated with a mixture of barium and strontium oxides), 1.1. The value of  $W$  for a given solid varies slightly with temperature and also depends on the crystallographic surface exposed; it cannot be accurately predicted by quantum theory.

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**WORK PROJECTS ADMINISTRATION (WPA)**, a former agency of the United States government, created in 1935 by executive order of President Franklin D. Roosevelt as the Works Progress Administration to provide useful public work for needy unemployed persons. It was renamed Work Projects Administration in 1939, when it was placed under the Federal Works Agency. It should not be confused with the PWA (see PUBLIC WORKS ADMINISTRATION). In its eight years of operation it employed about 8,500,000 individuals at a total cost of nearly \$11 billion. The average monthly wage, which varied according to skill and location, was \$54.33.

Sponsored usually by state or local agencies but paid for chiefly by the federal government, the WPA's projects were manifold. Under the construction program 651,000 miles of roads, 125,110 buildings, 78,000 bridges, and many airports, public utilities, and recreational facilities were built or improved. The art project produced paintings, drawings, sculpture, and more than 2,500 murals in public buildings. Writers prepared a number of notable guide books. The theater project developed striking dramatic techniques. Many kinds of musical groups gave thousands of performances. Adult education classes were conducted. Women engaged in sewing, gardening and canning, and school lunch enterprises. Until 1939, the WPA supervised the National

Youth Administration, which found part-time work for youths.

The WPA was praised for its physical accomplishments and its training of workers, but there were criticisms of waste and lack of planning and accusations that workers shirked and malingered. Appropriations were cut in 1939, and building workers struck unsuccessfully against wage reductions. With the approach of World War II, the WPA contributed to the national defense effort by its participation in construction at military installations. The war brought increasing employment, and on June 30, 1943, the agency was terminated.

**WORK SONGS.** At the end of the 19th century, Karl Bücher, a pioneer theorist on the origin of music, held that work songs were the original type of singing and that rhythm first appeared as a coordinating element for group effort. Although this is an appealing notion, in which there is probably some germ of truth, it was largely rejected as it was discovered that some primitive peoples had no work songs and that others sang songs at work which bore no rhythmic relationship to the task at hand.

Nonetheless, work songs are an old musical type. Where they occur, they often exhibit the song culture of a people in a fundamental form. When a verse, a tune, and a rhythm are joined in such a way that the people of a culture realize the maximal release of energy by singing at work, the song is not likely to change until the activity loses its importance. Thus, for instance, the songs of the porters of the salt works of Trapani, Sicily, retain a system of counting that goes back beyond any record of the salt works themselves. In the same way, the tuna-fishing chanteys used by the Sicilian fishermen hauling up their great undersea nets show strong African characteristics which are discoverable in no other Italian folk music and very probably date back hundreds of years to the time when similar fisheries flourished along the whole North African coast. The stone cutters in Portland Bill, England, still hew out the sandstone to chants that were used about 1700 when the architect, Sir Christopher Wren, was engaged in the construction of St. Paul's Cathedral using Portland stone.

Thus, work songs are more conservative than most other types of folk songs, even though new verses may be improvised continually by the work-song leader. At harvest time in Spain, Italy, and Corsica the threshing is done by driving horses and mules around and around through the newly cut grain while the drivers sing a wailing appeal to the Virgin to keep their mules strong and safe from accidents. The same activity is depicted in ancient Egyptian art, and there is a fragment of an ancient Egyptian text encompassing a point of view that would not seem outlandish to a Mediterranean peasant today.

**Work-Bee Songs.**—All through peasant Europe and in pioneer America, where wool was carded, corn was husked, and the innumerable tasks of the farm were performed, the people came together in work bees, in which singing played an important part. Young people played games, courted, and picked out their future mates while work songs inspired the group to complete its task. Such songs are still an important part of peasant life in eastern Europe, rural Italy, and among the Basques.

Perhaps the most striking survivals of this



work-bee custom in the West are the so-called waulking songs of the Hebrides in Scotland. The manufacture of wool and tweed of this region was one of the principal activities of women. A suit of heavy tweed protected a man from the rigors of wet and cold as he hunted, fished, and tended his flock in his wintry world. Thus, a stout waterproof length of tweed was the strongest expression of feminine care for a man. In the last stage of tweed making, the women gathered in a cottage to hand-shrink the cloth. They dipped it in a shrinking solution and then rhythmically pounded it on a wooden table and passed it from hand to hand around the work circle. While they kneaded the tweed, they sang songs of erotic and heroic content, the leader giving out the verses and her companions joining in superb unison on the rolling, chanteylike refrain. Even today, when the handicraft of tweed making has almost disappeared, folklorists have recorded hundreds of waulking songs in the Hebrides, and these noble work songs are still sung by the Gaelic-speakers of Nova Scotia at their parties.

In all such songs the singing leader expresses the joint sentiments of his group, and the work-song chorus immediately affirms in its refrain what he has stated. Thus, in the work song one can see the human community in action, making what it needs and at the same time voicing its fantasies and its desires, often in very uninhibited fashion. Indeed, the texts of work songs are often the most frankly erotic of all folk music. In a group of Haitian peasants engaged in preparing a field for cultivation with their hoes, the song leader indulges in the wildest fantasies of erotic humor to keep his comrades amused and heartened. Hardly a word of such text could be printed without shocking most readers. Sicilian sea chanteys concern only one topic—sex; and all collectors of the Anglo-American sea-chantey tradition have confessed privately that the texts of most of these songs must be toned down for print.

**Sea Chanteys.**—Sea chanteys not only candidly describe the pleasures of sailors ashore, but deal frankly with the character of the officers who commanded the ships and the harsh conditions of work and life on board. The work-song leader voicing the woes of his comrades has apparently long been important in the work-song tradition:

A Yankee ship came down the river,  
Blow, boys, blow,  
Her masts and spars, they shone like silver,  
Blow, boys, blow.  
And who do you think was the captain of her?  
Old Bully Hayes the devil-driver.  
And what do you think we had for dinner?  
Monkey heart and baboon liver.

The custom of singing chanteys aboard sailing vessels is very probably prehistoric. Francisco Fabri, a 15th century Venetian friar, aptly sums up the importance of the custom: "There are others who sing when work is going on, because work at sea is very heavy, and is only carried on by a concert by one who sings out orders and the laborers who sing in response."

It was natural that a seagoing nation like England became the home of sailor work songs. Probably the chanteys *Bouline* and *Amsterdam Maid* were familiar to the men who adventured for Queen Elizabeth I. Thereafter, the chantey flourished in the British Navy and merchant marine until about the middle of the 18th century. Shipboard discipline became much more formalized after that time, and no spontaneous singing

was permitted. The independent seafarers of the American colonies kept up the custom, however, and in the 19th century Irish-American and Afro-American chanteymen took over all of the old songs and contributed many new pieces to the tradition. Thus, during almost a century, the sea chantey was thoroughly Americanized, and some of the noblest songs, such as *Shenandoah* and *Johnny, Come Down to Hilo*, spread from American ships to the merchant marine of the whole English-speaking world.

The testimony of the men who drove the clipper ships at a speed no man had sailed before was unanimous on one point: without the enlivening and coordinating melodies of the sea chantey, these ships never could have been sailed at all. The chantey put heart and muscle into men furling a heavy sail in a storm and made it possible for them to match their strength against the wind and the sea. Songs such as *Mobile Bay*, *Hanging Johnny*, *Rio Grande*, and *Whiskey Johnny* became familiar in every port and on every ocean of the planet. No matter how hard and dangerous the passage, no matter how brutal and tyrannical the officers, no matter how rotten and unpleasant the food, the chanteyman could voice the feelings of his mates and knit them together in anger and a common will to survive somehow and drive their vessel on.

There were rhythmic work songs for every shipboard task where concerted group action was necessary, and for the hours off watch in the fore-castle there were splendid ballads of wrecks, sea fights, and pirates to while away the time. Both these types of Anglo-American sea songs deeply influenced the development of the work song in the United States. The sea chantey became a model for Negro longshoremen in the ports along the Atlantic and Gulf coasts, and these slave singers began at once to contribute new verses and new songs to the sea tradition:

Oh, was you ever in Mobile Bay,  
Lowlands, lowlands, away my John,  
A-screwing cotton by the day,  
My dollar and a half a day.

Echoes of this genre are still to be heard along the Georgia coast, where old-time longshoremen sing:

Pay me or go to jail,  
Pay me my money down,  
Pay me, Mister stevedore,  
Pay me my money down.

**Forecastle Ballads.**—During the War of Independence and the War of 1812 numerous ballads were composed celebrating American heroes like John Paul Jones and relating America's victories at sea. Concurrently whalers, fishermen, and clipper-ship sailors were adapting the British sea-ballad tradition to their own purposes in songs such as:

From Boston Harbor we set sail  
When it was blowing a devil of a gale,  
With our ring tail set on abaft the mizzen peak  
And our dolphin striker plowing up the deep.

We poor sailors standing on the deck  
With the blasted rain all pouring down our necks  
Not a drop of grog did he to us afford  
And he damns our eyes with every other word.

The harsh conditions of the seamen's life during the early part of the 19th century caused many American sailors to stay ashore and seek their fortunes on the expanding American frontier. In this way the familiar ballads and ballad forms of the fore-castle soon reappeared in the work ballads

of lumbermen, miners, cowboys, lake sailors, and canallers. For example, the *Sailor's Alphabet*,

A is the anchor that ships from the bow,  
B is the bowsprit that puts from the prow,  
C is the capstan we merrily go 'round, and  
D is the derrick that throws us all down . . .

Soon was transformed into the *Lumberman's Alphabet*:

A is for ax you very well know,  
And B is for boys that can use them just so,  
C is for chopping, and now I'll begin,  
And D is for danger that we're oftentimes in.

The sentimental sailor song *Bury Me Not in the Deep Blue Sea* was touched with the melancholy of the lonely cowboy on the Western plains and became *Bury Me Not on the Lone Prairie*. There are numerous examples of ballads that passed through several stages of transformation, from forecastle song to lumberman's song and finally to cowboy ballad.

**"Come-All-Ye" Ballads.**—The majority of the foregoing American work ballads were modeled on the style of the Anglo-Scots-Irish come-all-ye ballad that sprang up during the 18th century. Such songs were turned out in the tens of thousands by the ballad presses of London, Glasgow, and Dublin to document the lives, loves, and attitudes of the rising British working class. Their simplicity and matter-of-factness caused them to replace the older ballads, such as *Sir Patrick Spens* and *The Douglas Tragedy*, which treated largely of the lives of the upper classes. In America, especially among the freeborn workmen of the woods and the rivers, the democratic, journalistic come-all-ye became the universal model for song making.

During the period that the American woods tiger cleared the coniferous forests from Maine to Washington, the principal form of recreation during the lonely winter months in the bunkhouses was singing and composing ballads. The life was hard, the work was arduous, and the lumberjack was threatened by danger in the woods, on the skid roads, and on the wild river drives. Some of his ballads seem overly sentimental to us today, but they capture, as no other literature does, the period and the feelings of these men who supplied the lumber for the growth of a young nation:

The choppers and the sawyers, they lay the timber low,

The skidders and the swamper, they holler to and fro,

Next come the sassy loaders before the break of day,  
"Come load your teams, my bully boys, and to the woods away."

One of the ballads recounts a hauling contest between two teams of oxen:

Not a thing on the river McClusky did fear,  
As he swung his gourd stick o'er his big, spotted steers,

They were round, plump and handsome, girtin' eight feet and three,  
Said McClusky the Scotchman, "They're the laddies for me."

Then along came Bull Gordon, whose skidding was full,

As he hollered, "Woah, hush," to his little brown bulls,

Short-legged and shaggy, girtin' eight feet and nine,  
"Too light," said McClusky, "to handle our pine."

The most popular of these songs and the model for the most frequent type was *The Jam on Gerry's Rocks*, which recounts the death of a heroic young riverman during a log jam. Although many old lumberjacks swore they knew the very spot in the river where the fatal incident occurred, researchers have never been able to locate Gerry's



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The dangerous life of the lumberman was reflected in the melancholy ballads he composed and sang about his work.

Rocks or discover any more facts than those recounted in the ballad itself. In truth, the ballad—a fantasy about a sympathetic hero—and its discovery in Ireland and Scotland indicate that its appeal lies more in fantasy than in reality.

Perhaps the function of the majority of these work ballads was to voice the valid complaints of the men about the hard conditions of their lives. One song was sung with equal relish by the woodsmen of Maine, Michigan, and Canada:

To describe what we have suffered is past the art of man,

But to give a fair description, I will do the best I can;

Our food the dogs would snarl at, our beds were in the snow,

We suffered worse than murderers in Canady-i-o.

Our hearts were made of iron and our souls were 'cased in steel,

The hardships of that winter could never make us yield;

Field, Phillips and Norcross, they found their match I know

Among the boys that went from Maine to Canady-i-o.

This ballad was recreated and given an epic grandeur by the buffalo hunters of the stake plains. When John A. Lomax brought *The Buffalo Skinners* to the attention of George Lyman Kittredge, founder of American ballad research at Harvard University, Kittredge declared it the finest

American folk ballad; yet, true to the come-all-ye tradition, it was in essence a remake of the lumberjack song:

Our hearts were 'cased in buffalo hocks, our souls  
were 'cased in steel,  
The hardships of this summer, they surely make  
us reel,  
In skinning them damned old stinkers, our lives they  
had no show,  
For the Indians waited to pick us off on the range  
of the buffalo.

**Cowboy Songs.**—Isolation has often played an important part in the development of a new branch of folklore. It was, perhaps, the most important factor in the growth of the large literature of cowboy songs discovered by Lomax in his research, sponsored by Harvard University, during the first years of the 20th century. The cowhands lived most of the year on lonely ranges, banding together for cattle drives across the vast and empty stretches of the Western plains, or coming together for brief periods of jollification, at such centers as Abilene, Kans., or Cheyenne, Wyo. Their cultural origins were diverse; Southern mountaineers, ex-lumberjacks, expatriate Englishmen, Irish navvies, desperadoes, Mexicans, Negroes—such were the components of the cowboy melting pot. In their diverse styles, their songs and ballads reflect this human vitality. Some were parodies of music-hall songs; others were reworkings of English ballads and well-known American folk songs from the East; one or two show French Canadian influence; the major type belongs to the come-all-ye strain. Their heroes were brave cowboys, faithful and agile cow ponies, and the ever-present little dogies—the orphan calves that moved along at the tail of the herd.

Cowboy songs described in tragic, sentimental, and humorous fashion the dreary life of the cowhand and the conditions and adventures of his work. A pervasive theme is the loneliness of a male who has turned his back on his family and all normal society for the solitude of the plains

Loneliness was a common theme in the songs of the cowboys who drove their herds across the western plains.

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and an entirely masculine society. Perhaps the most typical, as well as the most evocative, of all cowboy songs is the cattle lullaby *Git Along, Little Dogies*. In its original Irish form, the song satirizes an old man married to a gay young wife who leaves him at home to rock the baby while she goes out to dance. He mournfully speculates on the paternity of the child in his arms. The cowboy transforms the baby into the dogie, which he often carried on the pommel of his saddle, and links his fate with that of his charge in a mournful chorus.

Whoopee-ti-i-o, git along little dogies,  
It's your misfortune and none of our own,  
It's whoopin' and cursin' and damnin' those dogies  
To their soul's perdition and none of our own.

**Labor Songs.**—Songs about work have been discovered for a wide range of activities. The forty-niners had their songs, as did the copper miners, the lake sailors, the canal boatmen, and the miners of hard and soft coal in Kentucky and Pennsylvania. George G. Korson has collected a large literature of topical ballads in the American coalfields, which present a picture of the miner at work, at play, and on strike. As the American movement to the West became more and more industrialized, a new note of militancy appeared in these topical songs. The Industrial Workers of the World (IWW), the so-called Wobblies, capitalized this sentiment in their organizing songs, many of them composed by the now legendary Joe Hill. These songs, compiled into a little chapbook called *The Red Song Book*, were known to all the wandering workers of the West during the period before World War I and proved tremendously effective in their organizing drives. This new strain of topical songs from the militant working class again and again produced new batches of local ballads during the 1920's and the years of the depression. The tenant farmers of Arkansas had their song literature. The embattled soft-coal miners of eastern Kentucky discovered a number of bards in their midst, notably Aunt Molly Jackson, who rhymed their cause into rough but strong ballad poetry. The violent years of the textile workers' union in the South Atlantic states—the late 1920's and the early 1930's—gave rise to another batch of strike poetry. All of this material served its local usefulness, was circulated by word of mouth, and has subsequently been reprinted in various publications such as *The Peoples' Song Book*.

**American Negro Work Songs.**—By far the richest veins of American work songs, however, are the rhythmic work chants of the American Negroes. A number of travelers in the low-lying coastal regions of the Atlantic states and in Mississippi in antebellum days were deeply impressed by the paddling songs of the Negro slave crews who transported them from place to place. These wild and, to the ears of their European listeners, barbaric chants seem to have been closely related to African work songs. The melodies that have been preserved are among the most exotic discovered on the North American continent. This tradition seems to have survived to some extent in the longshoreman chants of Charleston, S.C., and Savannah and Brunswick, Ga. Fortunately, Mrs. Maxfield Parrish organized a group of singers on St. Simons Island, Ga., who knew how to sing some of these primitive American work songs. They are to be found in her book and were recorded in 1902.

These Sea Island songs are characterized by

complex rhythms, by an antiphonal linking of leader with chorus, and by the regular use of some intervals which are more reminiscent of African melodies than of European. Their form is typical of the majority of American Negro work songs. The leader initiates a half line:

LEADER: Kneebone, didn't I call you?  
 CHORUS: (overlapping the leader's last note):  
 Oh, Lawd, kneebone!  
 LEADER: (overlapping the chorus' last note):  
 Called you in the morning!  
 CHORUS: (overlapping): Oh, Lawd, kneebone bend!

United by this rhythmic chant, the work gang heaved together at the same instant and, by these spaced concentrations of energy, moved a huge timber into place in the hold of a lumber schooner. The leader improvised verses to suit the mood of the moment and the events of the day, keeping the men diverted from the heat, the dirt, and the weariness of the job. Between pulls the men had a moment to relax all together, and a strong group emotion fused them into a unit for the moments of exertion. Thus, formidable tasks were accomplished in a fashion common to all West African cultures. Slave owners recognized the importance of work songs; frequently talented slaves were selected to do nothing but sing while their companions worked and joined in the chorus. Thus, the grueling labor of clearing the land of the South and cultivating it was lightened for generations of toiling slaves by ax songs, cotton-picking songs, cane-cutting songs, plowing songs, corn-husking songs—in fact, by songs for every type of group labor—composed by unknown work bards.

There can be no question that, without these songs for group labor, the big jobs of opening up the South would not have been accomplished. The levees along Southern rivers were built largely by Negro mule skimmers, who handled teams of mules dragging heavy steel scoops. These highly skilled levee camp workers sang all day at their work, their high, wailing voices rising through the dust and heat as they rhymed out their sorrows and their ironic observations about life and love. These levee camp hollers were most common in the Mississippi delta, and it seems very likely, from their melodic shape, that they were the raw stuff out of which the now famous American Negro folk blues developed. Typical verses

I looked all over the whole corral,  
 I couldn't find a mule with his shoulder well.  
 I asked my captain to give me a dime,  
 He said, "Sorry, old bully, you're a dime behind."  
 I asked my captain when the money would come,  
 He said, "The river is foggy and the boat won't run."

Both road building and, especially, railroad construction developed special Negro work-song types of their own. Until the 1930's, the construction gangs on every Southern railroad sang for each separate operation in laying a road—pick-and-shovel songs for the right of way, tie-toting chants, steel-calling chants for dumping the heavy rails, tie-tamping songs for packing the gravel around the ties, track-lining songs for aligning the track, and spike drivers' songs for spiking the rails home to the ties. All railroad work songs are signalized by a special mood of tenderness and gentle irony, as in the following couplets:

Matty and the baby layin' in the shade,  
 Figurin' and studyin' on the money I ain't made.  
 You fool the captain and I fool the straw,  
 But the general road manager, he's gonna fool us all.  
 Railroad workers were better paid and better

treated and had more independence than the generality of Negro labor during the 19th and early 20th centuries, and this fact is reflected in the mood of their work songs. A heroic note, new to the South, began to be heard in their verse. The spike driver, swinging his hammer in flashing arcs over his shoulder, sang:

When you hear my hammer fallin',  
 Steel's runnin' like lead, Lawd, Lawd,  
 Runnin' like lead.

This old hammer killed John Henry,  
 Can't kill me, Lawd, Lawd,  
 Can't kill me.

In these lines we find probably the earliest reference to America's earliest work hero, John Henry, the steel-driving man. John Henry probably stands for Mr. Anonymous. Little John was an English folk hero. 'Ti Jean appears as the hero of folk tales in France, Canada, and Haiti. Ol' John played tricks on his slave master in many a slave folk tale. John Henry, according to the legend in the 1870's, matched his strength against the first automatic steam drill, won the contest, and died of overwork, immortalizing the lines:

A man ain't nothin' but a man,  
 Before I'd let your steam drill beat me down,  
 I'd die with my hammer in my hand.

His ballad has been found among Negroes and whites everywhere in the South and, with the rising popularity of folk songs, has become a national song that is still growing.

**Chain Gang Songs.**—During the cruel years of Reconstruction, the old slave system perpetuated itself in forced labor drafts, by means of which state roads were constructed and huge plantations farmed. Any Negro who got into trouble was headed for the chain gang, an institution that could be found in every Southern county and state between 1870 and 1930. In most of these prison camps even the simplest care once exercised by the slaveholders was abandoned. A prisoner who died was easily replaced by a new one. The men worked from "can to can't—from when you can see in the morning till when you

Negroes imprisoned on chain gangs found that rhythmic work chants seemed to ease their burdens.

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can't see at night." Food was the crudest:

You wake up in the morning,  
You hear the ding-dong ring,  
You go marching to the table,  
See the same damn thing.

The guards were often sadists:

You kicked and stomped and beat me, kind captain,  
And you call that fun, sir.

The slogan was, "Kill a mule, buy another; kill a Negro, hire another." Hundreds died of sunstroke, overwork, and brutality:

You oughta been here in 1904,  
You could find a dead man on every turn row.

Go down, Ol' Hannah (the sun),  
Don't rise no more,  
If you rise in the mornin',  
Set the world on fire.

Out of this human hell rose the voices of men who could look death in the face every day and defy it in laughing, ironic lines:

Cap'n got a pistol and he wanna play bad,  
Gonna take it in the mornin' when he makes me mad.

Ain't but the one thing I done wrong,  
Stayed in Mississippi just a day too long.

The thoughts of these men locked away from the world often by a double life sentence usually turned on the women whom they missed by night and day:

"Yonder comes little Rosie."  
"How in the world do you know?"  
"I know her by her apron  
And the dress she wore.  
Umberreler on her shoulder,  
Piece of paper in her hand;  
She's come to tell the captain:  
'Lawd I wants my man."

For the convicts who still kept their spirit, there was only one decision—when to run out from under the rifles of the guards:

Every mail day I gets a letter,  
"Son come home, son, come home,"  
I'm gonna bust right past that shooter,  
I'm goin' home, babe, I'm goin' home.

Their heroes were John Henry; Stewball, the magic racehorse whose feet were shod in gold; the Old Grey Goose, who couldn't be killed; Stagolee, the Memphis gambler and gunman; Po' Lazarus, who ran off with the camp payroll; and Long John, who could outrun anything moving:

Ol' John made a pair of shoes,  
The funniest shoes that were ever seen,  
Had a heel in front and a heel behind,  
So you couldn't tell where that boy was gwine.

He's long gone, like a turkey through the corn,  
He's gone, gone.

This prison-song literature is touched here and there with epic grandeur. The melodies are as powerful and deeply moving as the best of the spirituals. One singer said, "We starts singing early in the morning, and when we look around, it's dinner time." These songs kept the hearts of thousands of men alive and whole during conditions that match those of the Nazi concentration camps of World War II. They stand for the noble and dauntless spirit of men everywhere.

ALAN LOMAX

Coeditor of "Our Singing Country"

Further Reading: Fing and Cowboy Songs (Folc  
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Work and Protest (1960; reprint, Dover 1973); Leopold, Vin-  
cent, *The Alliance and Labor Songster* (1891; reprint, Ayer  
1975); Stevens, Denis, ed., *A History of Song* (1960; reprint,  
Greenwood Press 1982).

**WORK-STUDY PROGRAM**, a plan by which students, usually at the college level, alternate periods of on-campus academic study with periods of full-time, paid employment. The program originated in the School of Engineering at the University of Cincinnati. See also BUSINESS EDUCATION; VOCATIONAL EDUCATION; and the Index entry *Work-Study Program*.

**WORKMAN, Fanny Bullock**, American explorer and mountain climber: b. Worcester, Mass., Jan. 8, 1859; d. Cannes, France, Jan. 22, 1925. Daughter of Gov. Alexander Hamilton Bullock of Massachusetts, she married (1881) a prominent physician, William Hunter Workman (1847-1937), with whom she traveled in Europe, North Africa, and the Far East. From 1899 to 1912 they explored and mapped parts of the Himalaya and Karakoram ranges, making several first ascents of peaks over 20,000 feet. In 1906, Mrs. Workman established on one of the peaks of Nunkun in Kashmir a world's record ascent for women (23,300 feet). The Workmans collaborated on eight books of travel, notably *In the Ice World of Himalaya* (1900); *Ice-Bound Heights of the Mustagh* (1908); *Peaks and Glaciers of Nun Kun* (1909); *The Call of the Snowy Hispar* (1910); and *Two Summers in the Ice Wilds of Eastern Karakoram* (1917).

**WORKMEN'S COMPENSATION**, payment of benefits to injured employees or to dependents of those killed at work, regardless of fault. The laws of individual states of the United States vary. Some apply only to those in hazardous work; others apply only where employees are not less than a specified number. See also SOCIAL SECURITY—U. S. *Developments*.

**WORKS PROGRESS ADMINISTRATION**. See WORK PROJECTS ADMINISTRATION.

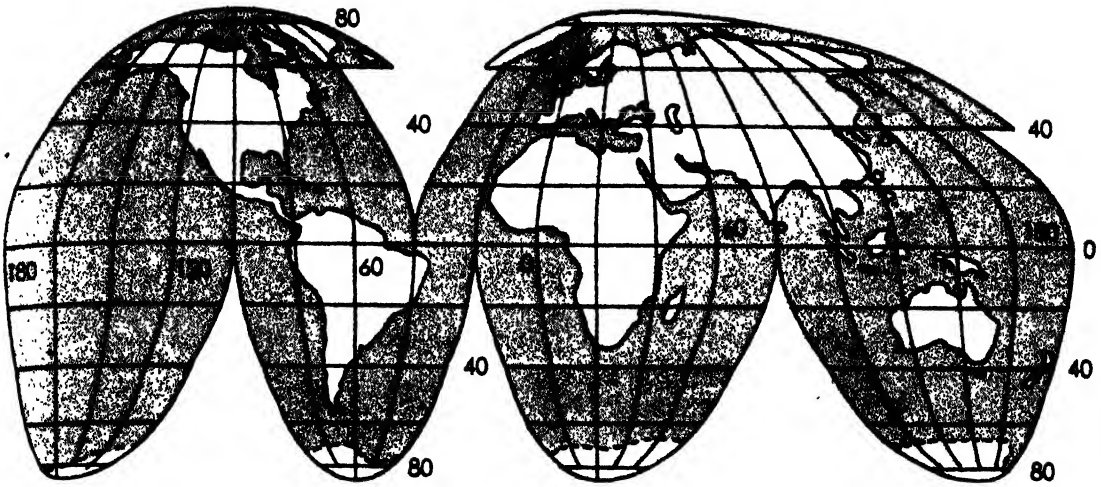
**WORLD**, in the most comprehensive sense, the universe, including the earth and the heavens; in a more restricted sense, the earth and its inhabitants. For a discussion of the world in the first sense, see the article UNIVERSE. The present article deals with the subject in the second sense—the earth as the habitat of man. For a discussion of the earth as part of the solar system, see EARTH.

The earth as the habitat of man presents two kinds of environmental elements: physical and biological. Among the physical elements are continents and oceans, weather and climate, landforms, soils with the rocks from which they are derived, and water. The biological elements include flora, fauna, and the peoples of the world. None of these, either physical or biological, exists alone, unrelated to the others. In recurring combinations, they form a sort of mosaic of major geographical regions that is the world. In the following discussion, the physical environment is considered first, and then the biological environment.

#### PHYSICAL ENVIRONMENT

**Continents and Oceans.** The earth approximates a sphere in shape, but is somewhat flattened in the polar regions. The diameter from North to South Pole is 7,899.99 miles; halfway between the poles, it is 7,926.68 miles. Furthermore, the face of the earth is far from uniform. The solid crust sags inward in some places and bulges out-





Only 29 percent of the earth's surface is land; the rest is covered by water.

ward in others. In the sags, water covers the solid crust, forming oceans and seas; the bulges rise above these waters as continents and islands. Both sags and bulges are of varied size and are irregularly arranged. All of the sags are interconnecting, so that the bulges are separated and are entirely surrounded by water. The distribution of land and water is the world's basic physical feature.

Only 29 percent of the surface is land. Largest of the land masses is that which includes Europe, Asia, and Africa. Traditionally called separate continents, they are actually one huge land mass broken only by a man-made waterway, the Suez Canal. This land mass, with adjacent islands, constitutes 57 percent of all the land area. Second largest is the land mass that includes North and South America and the narrow connecting land bridge of Middle America, broken only by the Panama Canal. This land mass is just under half the size of Europe-Asia-Africa. Third is the ice-covered continent of Antarctica, centered on the South Pole and constituting 9 percent of the world's land area. The smallest land mass of continental size is Australia, with 5 percent of the land area. Thus, nearly all of the world's land area, 57,225,000 square miles, is included in four land masses with their adjacent islands. See also **CONTINENT**; and articles on the individual continents.

Water covers 71 percent of the surface. West of the Americas, east of Asia and Australia, and north of Antarctica lies the Pacific Ocean, largest and deepest of the world's water bodies, covering about 64 million square miles. If all the land area of the world were fitted into the Pacific basin, a water area larger than Antarctica would still remain. The Pacific opens eastward into the Atlantic Ocean between South America and Antarctica. Separating the Americas from Europe-Asia-Africa, the Atlantic is half the size of the Pacific. Between Africa and Antarctica, the Atlantic leads to the Indian Ocean, which lies between Africa, Asia, Australia, and Antarctica. One tenth smaller than the Atlantic, the Indian Ocean is larger than any of the world's land masses except Europe-Asia-Africa. Centering on the North Pole and opening southward to both the Pacific and Atlan-

tic is the smallest of the world's oceans, the Arctic. Only slightly larger than Antarctica, it is mostly ice-covered throughout the year.

Oceans indent continental shores to form many bodies of water, almost surrounded by land, known as seas. The largest of these is the Mediterranean (965,000 square miles), which with its eastward extension, the Black Sea (173,000 square miles), forms the traditional break between Europe and Africa and between Europe and southwestern Asia. Other large seas include the Bering (878,000 square miles), between Alaska and Asia; the Caribbean (750,000 square miles), indenting southeastern North America; the Sea of Okhotsk (590,000 square miles), on the northeastern Asiatic coast; and the Sea of Japan (400,000 square miles), between the Japanese islands and the Asiatic mainland.

See also **OCEAN**, **THE**; and articles on individual oceans and seas.

**Weather and Climate.**—The earth's surface lies under a thick blanket of atmosphere which makes life as we know it possible. It provides relatively narrow temperature ranges in which man, other animals, and plants can exist, and it makes available water, upon which all life depends.

The atmosphere is a mechanical mixture of gases with finely divided solid impurities: 78 percent of the volume of dry air is nitrogen and 21 percent is oxygen; the remainder includes several inert gases and a small proportion (about 0.03 percent) of carbon dioxide. Oxygen is necessary for all living things in the cellular oxidation of food, which releases energy. Carbon dioxide is essential for plant growth. The proportion of elements remains relatively fixed in the lower atmosphere; only at heights over 40 miles is there appreciable change. There is less available oxygen and carbon dioxide as height increases, because the particles of all gases are more widely separated from one another.

Water vapor and solid impurities are present in the lower atmosphere, varying in amount from place to place and from time to time. At a maximum, water vapor approaches 4 percent of the air by volume; at a minimum, it is almost entirely absent. Solid impurities include microorganisms,



Wide World

This photo was sent by Tiros 7 on June 20, 1963 from a height of 450 miles. The curvature of the earth can be seen, as well as the constantly changing atmosphere.

chemical salts, smoke, and dust. Even the finest particles are effective in promoting moisture condensation and precipitation.

The atmosphere is a mobile and constantly changing body. Because of this and because of the earth's motions as a planet, weather varies both in place and time, creating many different climates. Weather means the state of the atmosphere at a given place and time, while climate is the average state of the atmosphere at a given place over a considerable period of time. Weather can be observed directly; climate can be determined only from past records. Yet, climate does imply expected weather types and provides a measure of differences and similarities from place to place. The general climatic pattern is modified locally by latitudinal position, detailed arrangement of land and water, size of land mass, altitude, and surface relief.

**Low Latitudes.**—From 0° to 30° latitude, the outstanding climatic characteristic is the absence of a cool season or winter. Temperatures are always high; although they rarely reach 100° F., they seldom fall below 60° F. Often the temperature difference between day and night is greater than that between the averages of the warmest and coolest months. There are three principal patterns of precipitation. Along the equator and east coasts, precipitation is heavy and evenly distributed throughout the year. Farther from the equator and inland from east coasts, it is heavy in the warmer part of the year, but there is drought during the cooler part. Between these extremes are areas with enough rain during the warmer season so that, even though a dry period occurs, there is no drought. Climate with precipitation throughout the year is the *tropical rain forest* type; that with rain in one season and drought in the other is the *savanna* type; that with a dry season, but no drought, is the *tropical monsoon* type.

Still farther from the equator and east coasts, the range of temperature between the warmest and coolest months becomes greater, and the dry period becomes longer and drier. Eventually, *semiarid* and *arid* climates are encountered. Dry climates occur along continental west coasts be-

tween 20° and 30° latitude, reaching inland and poleward to continental interiors in the middle latitudes. The hearts of these zones are the driest areas in the world, while the outer fringes are semiarid, giving way to humid conditions poleward and toward each coast.

**Middle and High Latitudes.**—In middle latitudes (30° to 60°), flanking the dry interiors there are areas of moist climates which have in common marked temperature seasons. East of the dry interiors are areas of *humid subtropical* or *subtropical monsoon* climate. The former have mild winters, hot summers, and plentiful precipitation throughout the year; the latter have similar temperatures, but with summer rain and winter drought. West of the dry interiors are areas of *Mediterranean* and *mid-latitude marine* climate. Mediterranean climate has mild winters, either warm or hot summers depending on location close to the coast or inland, and precipitation concentrated in winter, summer being a drought season. Mid-latitude marine climate has mild winters, warm to cool summers, and plentiful precipitation throughout the year.

In higher middle latitudes and high latitudes (60° to 90°) in the Northern Hemisphere, northward from the mild-winter and dry climates is a belt, narrow at the coasts and wide in the interior, of *humid continental* climate, characterized by severe winters. On the southern margin, summers are hot but become progressively cooler and shorter northward. Precipitation is plentiful and evenly distributed through the year except in the interior, where it is concentrated in summer. Severe winter climates do not occur in the Southern Hemisphere because there are no land areas large enough to produce great temperature ranges in these latitudes. The Arctic and Antarctic areas have *polar* climates, whose significant feature is the absence of a really warm season or summer.

See also ATMOSPHERE; CLIMATE; CLIMATOLOGY, APPLIED; METEOROLOGY; RAINFALL. WEATHER.

**Landforms.**—The earth's crust has been broken, warped, wrinkled, and eroded into an immense variety of shapes. These landforms may be large or small, complex or simple. Locally, detailed landforms are highly significant in determining habitat quality, and major landforms provide guidelines to the world pattern. Major landforms are mountains, plateaus, plains, and hills. Each continent has a distinguishing landform distribution.

Mountains surround the Pacific Basin. The Aleutian Islands of southwestern Alaska represent peaks of a submerged mountain belt which continues through southern Alaska, western Canada, and into the western United States. After a short break, mountains continue through Middle America and southward through western South America. After another break, the mountains, nearly entirely covered by ice, cross Antarctica. With many breaks, partially drowned mountains, reappearing first in New Zealand, form island arcs along the east coast of Asia and back to the Aleutians. Other mountains exist on the Europe-Asia-Africa land mass, radiating in three belts from the Pamir mountain node, where Pakistan, Afghanistan, China, and the USSR come together. One stretches westward through southern Europe, ending in the Atlas Mountains of northwestern Africa; one stretches generally eastward between India and China, then southeastward through Indonesia; the third reaches northeastward into

# WORLD

Abidjan, Ivory Coast	O 5	Bhutan	U 4	DeLong (isls.), U.S.S.R.	D 2	Hong Kong	B 4
Accra (cap.), Ghana	O 5	Black Sea (bay), Europe	O 3	Denmark	P 3	Honolulu, U.S.	G 4
Addis Ababa (cap.), Ethiopia	S 5	Black Sea (arch.)	D 6	Denmark (strait)	N 2	Honshu (is.), Japan	D 4
Adelaide, Australia	S 5	Black (sea)	R 3	Denver, U.S.	J 3	Horn (cape), Chile	L 8
Aden (gulf), Asia	S 5	Blanc (cape), Africa	O 4	Detroit, U.S.	K 3	Houston, U.S.	K 4
Afghanistan	T 4	Bogota (cap.), Colombia	L 5	Diego Garcia (isl.)	F 5	Howland (isl.)	F 5
Africa	P 5	Boise, U.S.	J 3	Djibouti	R 5	Huambo, Angola	P 6
Amhadabad, India	T 4	Bolivia	L 8	Dniester (river), U.S.S.R.	R 3	Huang (river), China	B 4
Alaska (gulf), U.S.	G 3	Bombay, India	T 5	Dominican Republic	L 4	Hudson (bay), Canada	K 2
Alaska (state), U.S.	G 2	Bonin (isls.), Japan	D 4	Donetsk, U.S.S.R.	R 3	Hungary	P 3
Albania	P 3	Boothia (gulf), Europe	K 2	Drake (passage), S. America	L 8	Hyderabad, India	T 6
Albany, Australia	C 7	Borneo (isl.), Asia	B 6	Duclo (isl.)	H 7	Iceland	O 2
Altai (river), U.S.S.R.	C 2	Boston, U.S.	L 3	Dunedin, New Zealand	E 8	Igarka, U.S.S.R.	U 2
Antarctic (isls.), U.S.	F 3	Bothnia (gulf), Europe	R 2	Durban, South Africa	R 7	India	T 4
Alexandria, Egypt	R 4	Botswana	R 7	Dushanbe, U.S.S.R.	T 4	Indian Ocean	T 6
Angara	O 4	Bouvet (isl.)	P 8	East China (sea), Asia	C 4	Indigirka (river), U.S.S.R.	D 2
Angers (cap.), Algeria	P 4	Brazilia (cap.), Brazil	M 8	Easter (isl.), Chile	7	Indonesia	B 6
Ata-Ata, U.S.S.R.	T 3	Brazil	M 8	East Siberian (sea), Asia	D 2	Indus (river), Asia	T 4
Amazon (river), South America	L 6	Brazzaville (cap.), Congo	P 6	Ecuador	K 6	Iquique, Chile	L 7
Amazonas, Samoa	F 8	Brisbane, Australia	D 7	Edge (isl.), Norway	R 2	Iran	S 4
Ammassalik, Greenland	N 2	British Indian Ocean Terr.	T 6	Edmonton, Canada	J 3	Iraq	S 4
Amsterdam (isl.)	T 2	Brunei	B 5	Egypt	R 4	Ireland	O 3
Amu (river), U.S.S.R.	H 3	Bucharest (cap.), Romania	R 3	Elizmere (isl.), Canada	L 2	Irkutsk, U.S.S.R.	B 3
Anchorage (gulf), Canada	H 2	Buenos Aires (cap.), Argentina	L 7	El Paso, U.S.	J 4	Irish (river), U.S.S.R.	T 3
Amur (river), Asia	C 3	Bulgaria	R 3	El Salvador	J 8	Islamabad (cap.), Pakistan	T 4
Anadyr, U.S.S.R.	E 2	Burkina Faso	O 5	English (channel), Europe	O 3	Israel	R 4
Anchorage, U.S.	G 2	Burma	A 4	Equatorial Guinea	P 5	Istanbul, Turkey	R 3
Angara (riv.), U.S.S.R.	A 3	Burundi	R 6	Estonia	R 3	Italy	P 3
Angara	P 6	Cabinda, Angola	P 6	Ethiopia	R 5	Ivory Coast	O 5
Ankara (cap.), Turkey	R 4	Cairo, (cap.) Egypt	R 4	Europe	P 3	Jakarta (cap.), Indonesia	B 6
Antananarivo (cap.)		Calcutta, India	U 5	Faeroe (isls.), Denmark	O 2	Jamaica	K 6
Madagascar	S 6	Calgary, Canada	J 3	Falklands, U.S.	G 2	Jan Mayen (isl.), Norway	O 2
Antarctic (pen.)	L 9	Callao, Peru	L 8	Falkland (isls.)	M 8	Japan	D 4
Antarctica	B 9	Cambodia	B 5	Farwell (cape), Spain	M 3	Japan (sea)	C 3
Antarctica (isls.) New Zealand	E 8	Cameroun	P 5	Fiji	E 6	Java (isl.), Indonesia	B 6
Antofagasta, Chile	L 7	Campbell (isl.), New Zealand	E 8	Finisterre (cape), Spain	O 3	Jinan, China	B 4
Arabian (sea), Asia	T 5	Canada	J 3	Finland	R 2	Johannesburg, S. Africa	P 7
Arabia (sea)	C 6	Canary (isls.), Spain	N 4	Formosa (Taiwan) (isl.), China	C 4	Johnston (atoll)	F 5
Araguaia (river), Brazil	M 6	Canberra (cap.), Australia	D 7	Fortaleza, Brazil	N 6	Jordan	R 4
Aras, U.S.S.R.	S 3	Cannanore (isls.), India	T 5	Fort Yukon, U.S.	G 2	Juan Fernandez (isls.), Chile	K 7
Archangel, U.S.S.R.	S 2	Canton (isl.)	F 6	France	O 3	Juneau, U.S.	H 3
Arctic Ocean	D 1	Cape Town (cap.), South Africa	P 7	Franz Joseph Land (Frdrtof		Kabul (cap.), Afghanistan	T 4
Arequipa, Peru	L 6	Cape Verde	N 5	Nansen Land) (isls.),		Kalgoolie, Australia	C 7
Argentina	L 8	Caracas (cap.), Venezuela	L 5	U.S.S.R.	S 1	Kalinin, U.S.S.R.	R 3
Arkansas (river), U.S.	J 4	Caribbean (sea)	L 6	Frederik VI Coast (reg.),		Kamchatka (pen.), U.S.S.R.	D 3
Ascension (isl.)	O 6	Caroline (isls.)	D 5	Greenland	M 2	Kansas City, U.S.	J 4
Asia	B 3	Casablanca, Morocco	O 4	Fremantle, Australia	B 7	Kara (sea), U.S.S.R.	T 2
Asyarkhan, U.S.S.R.	S 3	Caspian (sea)	S 3	French Guiana	M 5	Karachi, Pakistan	T 4
Asuncion (cap.) Paraguay	L 7	Cayenne (cap.)		Fuzhou, China	B 4	Karaganda, U.S.S.R.	T 3
Atahualpa (lake), Canada	J 3	Ceylon (cap.)	M 5	Gabon	P 6	Kazan, U.S.S.R.	S 3
Athens (cap.), Greece	P 4	Celebes (isl.), Indonesia	C 6	Galapagos (isls.) Ecuador	K 6	Kennedy (cape), U.S.	L 4
Atlanta, U.S.	K 4	Central African Republic	R 5	Gambia	O 5	Kenya	R 5
Atu (isl.) U.S.	E 3	Central America	K 5	Ganges (river), India	U 4	Kerguelen (isls.)	B 8
Auckland, New Zealand	E 8	Ceylon (Sri Lanka)	U 5	Georgetown (cap.), Guyana	M 5	Kerulen (river), Asia	B 3
Auckland (isls.) New Zealand	D 8	Chad	P 5	Germany	P 3	Khabarovsk, U.S.S.R.	C 3
Australia	C 7	Chang (river), China	B 4	Ghana	O 5	Khar'kov, U.S.S.R.	R 3
Austria	P 3	Changchun, China	C 3	Gibraltar	O 4	Khartoum (cap.), Sudan	R 5
Accra (sea) Portugal	O 3	Changsha, China	B 4	Gibraltar (strait)	O 4	Khatanga (river), U.S.S.R.	B 2
Beaufort (bay), Canada	L 2	Chatham (isls.), New Zealand	F 8	Gilbert (isls.)	E 6	Kiev, U.S.S.R.	R 3
Beffin (isl.), Canada	L 2	Chelyabinsk, U.S.S.R.	T 3	Gizhga, U.S.S.R.	D 2	King Christian IX Land	
Baghdad (cap.), Iraq	S 4	Chengdu, China	B 4	Glasgow, Scotland	O 3	(region), Greenland	N 2
Bahamas	L 4	Chicago, U.S.	K 3	Gobi (desert), Asia	B 3	King Frederik VIII Land	
Bahia Blanca, Argentina	M 7	Chile	L 7	Godthab (Nuuk) (cap.),		(region), Greenland	N 1
Baikal (lake), U.S.S.R.	B 3	China	B 4	Greenland	M 3	Kinshasa (cap.), Zaire	P 6
Baker (isl.)	F 6	Chita, U.S.S.R.	B 3	Good Hope (cape), S. Africa	P 7	Kiribati	F 6
Baku, U.S.S.R.	S 3	Chongqing, China	B 4	Gorki, U.S.S.R.	S 3	Kiritmati (isl.)	G 5
Baku (ash) U.S.S.R.	T 3	Christchurch, New Zealand	E 8	Graham Bell (isl.), U.S.S.R.	T 1	Kolyma (river), U.S.S.R.	D 2
Baltic (sea) Europe	P 3	Christmas (isl.) Australia	B 8	Great (lakes), North America	K 3	Komandorskie (isls.), U.S.S.R.	C 3
Bamako, cap., Mali	T 5	Chukchi (pen.), U.S.S.R.	P 2	Great Bear (lake), Canada	J 2	Komsomolek, U.S.S.R.	C 3
Bangalore, India	O 5	Churchill, Canada	K 3	Great Slave (lake), Canada	J 2	Korea	C 4
Bangkok (cap.), Thailand	L 4	Cleveland, U.S.	K 3	Greece	R 4	Krasnoyarsk, U.S.S.R.	A 3
Bangladesh	A 5	Clipperton (isl.), Fr. Poly.	J 5	Greenland	M 2	Kulbyayev, U.S.S.R.	S 3
Banks (isl.), Canada	J 2	Cocos (isl.), Costa Rica	K 5	Greenland (sea)	O 2	Kunming, China	B 3
Batou, China	B 3	Colombia	L 5	Guadalajara, Mexico	J 4	Kuril (isls.), U.S.S.R.	D 3
Barbados	M 5	Colombo (cap.), Sri Lanka	T 5	Guam (isl.)	D 5	Kuwait	S 4
Barcelona, Spain	P 3	Comorin (cape), India	T 5	Guangzhou, China	B 4	Kyushu (isl.), Japan	C 4
Barents (sea), Europe	R 2	Comoros	S 6	Guatemala	K 5	Layoune, W. Sahara	O 4
Barrow, U.S.	G 2	Concepcion, Chile	L 7	Guayaquil, Ecuador	K 6	Labrador (reg.), Canada	L 3
Barrow (point), U.S.	G 2	Congo	P 6	Guinea	O 5	Labrador (sea)	M 3
Basra, Iraq	S 4	Congo (river), Africa	R 5	Guinea (gulf), Africa	P 6	Laccade (Cannanore) (isls.)	
Bass (strait), Australia	D 7	Cook (isls.)	F 8	Guinea-Bissau	O 5	India	T 5
Bathurst (isl.), Canada	K 2	Copenhagen (cap.), Denmark	P 3	Guyana	M 5	Ladoga (lake), U.S.S.R.	R 2
Battersee (cape), Antarc.	S 9	Coral (sea)	D 8	Hainan (isl.), China	B 5	Lagos (cap.), Nigeria	P 6
Beaufort (sea), North America	H 2	Cordoba, Argentina	L 7	Haiti	L 5	Lancaster (sound), Canada	K 2
Beijing (cap.), China	B 3	Costa Rica	K 5	Halifax, Canada	L 3	Lands End (cape), Canada	H 2
Belém, Brazil	M 6	Creta (isl.), Greece	R 4	Hanoi (cap.), Vietnam	B 4	Lanzhou, China	B 4
Belgium	P 3	Crozet (isls.)	S 8	Harare (cap.), Zimbabwe	R 8	Laos	B 5
Belgrade (cap.), Yugoslavia	P 3	Cuba	K 4	Harbin, China	C 3	La Paz (cap.), Bolivia	L 6
Belize	K 5	Cyprus	R 4	Hatteras (cape), U.S.	L 4	La Plata, Argentina	M 7
Belle Isle (strait), Canada	M 3	Czechoslovakia	P 3	Havana (cap.), Cuba	K 4	Laptev (sea), U.S.S.R.	B 2
Belo Horizonte, Brazil	M 3	Dakar (cap.), Senegal	O 5	Hawaii (isl.), U.S.	G 5	Latvia	R 3
Bengal (bay), Asia	U 5	Dalian, China	C 4	Hawaii (state), U.S.	F 4	Lebanon	O 5
Benghazi, Libya	R 4	Dallas, U.S.	K 4	Heard (isl.), Australia	T 8	Leeuwin (cape), Australia	R 4
Benin	P 5	Der es Salaam (cap.), Tanz.	S 6	Hebrides (isls.), Scotland	O 3	Lena (river), U.S.S.R.	B 7
Bering (sea)	E 3	Darwin, Australia	C 6	Heilinki (cap.), Finland	R 2	Leningrad (St. Petersburg),	
Bering (strait)	P 2	Davis (strait), North America	L 2	Hobart, Australia	D 8	U.S.S.R.	R 3
Berlin (cap.), Germany	P 3	Dawson, Canada	H 2	Ho Chi Minh City, Vietnam	B 5	Laos	R 7
Bermuda (isls.)	L 4	Delhi, India	T 4	Hokkaido (isl.), Japan	D 3	Lhasa, China	U 4
				Honduras	K 5	Liberia	O 6

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ibya	P 4	North (sea), Europe	P 3	Rotuma (isl.), Fiji	F 8	Taipei (cap.), Taiwan	C 4
ina (cap.), Peru	L 6	North (isl.), New Zealand	E 7	Rwanda	R 6	Taiwan (Formosa)	C 4
incin (sea), N. America	M 1	North (cape), Norway	P 2	Ryukyu (isls.), Japan	C 4	(isl.), China	C 4
labon (cap.), Portugal	O 4	North America	J 3	Sabah, Malaysia	B 5	Tanganyika (lake), Africa	R 6
lthuania	R 3	North Atlantic Ocean	M 3	Sahara (desert), Africa	P 4	Tanzania	R 6
ofoten (isls.), Norway	P 2	Northeast Land (isl.), Norway	R 1	Saigon (Ho Chi Minh City), Vietnam	B 5	Tapajós (river), Brazil	M 6
ofoten (cap.), England	O 3	Northern Dvina (river), U.S.S.R.	S 2	Saint Helena (isl.)	O 6	Tashkent, U.S.S.R.	T 3
opaka (cape), U.S.S.R.	D 3	Northern Marianas	D 5	Saint John's, Canada	M 3	Tasman (sea)	D 8
ord Howe (isl.), Australia	E 7	North Korea	C 4	Saint Lawrence (gulf), Canada	L 3	Tasmania (isl.), Australia	D 8
os Angeles, U.S.	H 4	North Pacific Ocean	F 4	Saint Lawrence (isl.), U.S.	F 2	Tbilisi, U.S.S.R.	S 3
ower Tunguska (river), U.S.S.R.	A 2	Norway	P 2	Saint Louis, U.S.	K 4	Tehran (cap.), Iran	S 4
oyalty (isls.), New Caledonia	E 7	Norwegian (sea), Europe	O 2	Saint Paul, U.S.	K 3	Teraina (isl.)	G 5
uanda (cap.), Angola	P 6	Novakichot (cap.), Mauritania	O 5	Saint Petersburg (Leningrad), U.S.S.R.	R 3	Thailand	B 5
ubumbashi, Zaire	P 6	Novaya Zemlya (isls.), U.S.S.R.	S 2	Saint Pierre and Miquelon (isls.)	M 3	Thailand (gulf), Asia	B 5
uzon (isl.), Philippines	C 5	Novosibirsk, U.S.S.R.	U 3	Saint Vincent (cape), Portugal	O 4	Thule Air Base, Greenland	L 2
vacau	B 4	Nyssa (lake), Africa	R 6	Sakhalin (isl.), U.S.S.R.	D 3	Tianjin, China	B 4
ackenzie (river), Canada	H 2	Ob (gulf), U.S.S.R.	T 2	Sala y Gómez (isl.), Chile	K 7	Tibet (reg.), China	U 4
vacuarie (isl.), Australia	D 8	Ob (river), U.S.S.R.	T 3	Salekard, U.S.S.R.	T 2	Tierra del Fuego (isl.), South America	L 8
Madagascar	S 6	Odessa, U.S.S.R.	R 3	Salt Lake City, U.S.	J 3	Timor (isl.), Asia	C 6
Vadaira (isl.), Portugal	O 4	Ohio (river), U.S.	K 4	Salvador, Brazil	U 3	Topo	C 6
Vadras, India	U 5	Olmekon, U.S.S.R.	D 2	San Francisco, U.S.	H 4	Tokyo (cap.), Japan	O 4
Vadrid (cap.), Spain	O 4	Okhotsk, U.S.S.R.	C 2	Santa Cruz, Argentina	L 8	Tomek, U.S.S.R.	U 3
Magadan, U.S.S.R.	D 2	Okhotsk (sea), U.S.S.R.	D 3	Santa Cruz (isls.), Sol Is.	E 6	Tonga	F 6
Magellan (strait), S. America	L 8	Olekminsk, U.S.S.R.	B 2	Santiago (cap.), Chile	L 7	Toronto, Canada	K 3
Magtitorok, U.S.S.R.	T 3	Olenak (river), U.S.S.R.	C 2	Santos, Brazil	M 7	Townsville, Australia	C 6
Malaw	R 6	Oman	S 5	São Francisco (river), Brazil	M 6	Trinidad and Tobago	M 5
Malaysia	B 5	Omsk, U.S.S.R.	T 3	São Paulo, Brazil	M 7	Tripoli (cap.), Libya	P 4
Maldives	T 6	Onega (lake), U.S.S.R.	R 2	São Roque (cape), Brazil	N 6	Tristan da Cunha (isl.)	O 7
Mali	O 4	Orange (river), Africa	R 7	Saratov, U.S.S.R.	S 3	Tromsø, Norway	P 2
Malvinas (Falkland) (isls.)	M 8	Orkney (isls.), Scotland	O 3	Sarawak, Malaysia	B 5	Tuamotu (arch.), Fr. Polynesia	H 6
Manaus, Brazil	C 5	Osaka, Japan	C 4	Sardinia (isl.), Italy	P 4	Tubul (Austral) (isls.), Fr. Polynesia	G 7
Mania (cap.), Philippines	R 7	Oslo (cap.), Norway	P 3	Saskatoon, Canada	J 3	Tucumán, Argentina	L 7
Maputo (cap.), Mozambique	H 6	Ottawa (cap.), Canada	L 3	Saudi Arabia	S 4	Tunis (cap.), Tunisia	R 4
Marquesas (isls.) Fr. Poly	O 3	Pakistan	T 4	Savannah, U.S.	L 4	Tunisia	R 4
Marais, France	E 5	Palau (isl.)	C 5	Schefferville, Canada	O 2	Turkey	R 4
Marshall (isls.)	O 5	Palmyra (isl.)	C 5	Scoreby (sound), Greenland	M 8	Tutuila (isl.), Amer. Samoa	F 6
Mauritania	T 7	Panama	K 5	Scotia (sea)	H 3	Tuvalu	F 6
Mauritius	T 8	Panama (canal), N. America	K 5	Seattle, U.S.	T 3	Uta, U.S.S.R.	S 8
McDonald (isls.) Australia	S 4	Papeete (cap.), Fr. Polynesia	G 7	Sempalatinsk, U.S.S.R.	O 5	Uganda	R 6
Mecca, Saudi Arabia	P 4	Papua New Guinea	D 6	Senegal	C 4	Ulanbaatar (cap.) Mongolia	B 3
Mediterranean (sea)	C 7	Paraguay	M 7	Seoul (cap.), South Korea	O 5	Ulan-Ude, U.S.S.R.	B 3
Melbourne, Australia	H 3	Paramaribo (cap.), Suriname	M 5	Severnaya Zemlya (North Land) (isls.), U.S.S.R.	B 1	Republics	B 2 S 3
Melencocino (cape), U.S.	J 4	Paraná (river), S. America	M 7	Seychelles	T 6	United Arab Emirates	S 4
Mexico	K 4	Paris (cap.), France	P 3	Shanghai, China	C 4	United Kingdom	O 3
Mexico (gulf), North America	J 4	Peace (river), Canada	H 3	Shenyang, China	C 3	United States	F 4 G 2 J 4
Mexico City (cap.) Mexico	J 5	Perry Land (reg.), Greenland	N 1	Shetland (isls.) Scotland	O 2	Upernivik, Greenland	L 2
Miam. U.S.	K 4	Persia, U.S.S.R.	S 3	Shokoku (isl.) Japan	C 4	Urul (river), U.S.S.R.	S 3
Midway (isls.)	F 4	Permian (gulf), Asia	S 4	Sicily (isl.), Italy	P 4	Uruguay	M 7
Mian. Italy	P 3	Perth, Australia	B 7	Sierra Leone	O 5	Urumqi, China	U 3
Mindanao (isl.) Philippines	C 5	Peru	L 6	Singapore	B 5	Valdivia, Chile	L 8
Minneapolis U.S.	R 3	Petrovskiy-Kamchatski, U.S.S.R.	E 3	Sitka, U.S.	H 3	Valparaiso, Chile	L 7
Minak U.S.S.R.	K 4	Philadelphia, U.S.	L 4	Society (isls.), Fr. Polynesia	G 6	Vancouver, Canada	J 3
Mississippi (river), U.S.	K 3	Philippines	C 5	Soetra (isl.), P.D.R. Yemen	S 5	Vancouver (isl.), Canada	H 3
Missouri (river), U.S.	K 3	Phoenix (isls.)	F 6	Solomon Islands	E 6	Vanuatu	E 8
Mogadishu (cap.) Sudan	S 5	Pitcairn (isl.)	H 7	Somalia	S 5	Venezuela	L 5
Mongolia	B 3	Plata, La (river), S. America	M 7	South (isl.), New Zealand	E 8	Vercruz, Mexico	K 5
Monrovia (cap.) Liberia	O 5	Platte (river), U.S.	J 3	South Africa	R 7	Verkhoyansk, U.S.S.R.	C 2
Monterrey, Mexico	J 4	Poland	M 3	South America	L 6	Victoria (lake), Africa	R 6
Montevideo (cap.), Uruguay	M 7	Port Elizabeth, S. Africa	R 7	Southampton (isl.), Canada	K 2	Victoria (isl.), Canada	J 2
Montréal, Canada	L 3	Port Hedland, Australia	B 7	South Atlantic Ocean	O 7	Vienna (cap.), Austria	P 3
Moosonee, Canada	K 3	Portland U.S.	H 3	South China (sea), Asia	B 5	Vietnam	B 5
Morocco	O 4	Pórt Alegre, Brazil	M 7	South Georgia (isl.)	N 8	Vilyui (river), U.S.S.R.	B 2
Moscow (cap.), U.S.S.R.	R 3	Portugal	O 3	South Korea	C 4	Vladivostok, U.S.S.R.	C 3
Mozambique	R 7	Pratoria (cap.), South Africa	R 7	South Orkney (isls.)	N 9	Voiga (river), U.S.S.R.	S 3
Mozambique (channel), Africa	R 7	Prinlibof (isls.), U.S.	F 3	South Pacific Ocean	H 7	Volgograd, U.S.S.R.	S 3
Murmanek, U.S.S.R.	R 2	Prince Rupert, Canada	H 3	South Sandwich (isls.)	N 8	Voronzh, U.S.S.R.	R 3
Murray (river), Australia	D 7	Puerto Montt, Chile	L 8	South Shetland (isls.)	L 9	Wake (isl.)	E 5
Murray (cap.), Oman	T 4	Puerto Rico	L 5	South-West Africa (Namibia)	P 7	Walvis Bay, S. Africa	P 7
Nagoya, Japan	C 4	Punta Arenas, Chile	L 8	Spain	O 3	Warsaw (cap.), Poland	R 3
Nairobi (cap.) Kenya	S 6	Qagortok, Greenland	M 2	Srednekolymsk, U.S.S.R.	D 2	Washington (cap.), U.S.	L 4
Namibia	P 6	Qagertarsuaq, Greenland	M 2	St. Lanka	U 5	Wellington (cap.) N.Z.	E 8
Nanjing, China	B 4	Québec, Canada	L 3	Stanley (cap.) Falkland Is	M 8	Western Sahara	O 4
Natal, Brazil	N 6	Queen Charlotte (isls.), Canada	H 3	Starbuck (isl.)	G 6	Western Samoa	F 6
Nauru	E 6	Queen Elizabeth (isls.), Canada	J 2	Stewart (isl.) New Zealand	E 8	West Indies (isls.) N. Amer.	M 5
N. Djama (cap.) Chad	P 5	Quito (cap.), Ecuador	L 6	Stockholm (cap.), Sweden	P 2	White (sea) U.S.S.R.	R 2
Nelson (river), Canada	K 3	Rabat (cap.), Morocco	O 4	Sucre (cap.), Bolivia	L 7	Whitehorse, Canada	H 2
Nepal	U 4	Race (cape), Canada	M 3	Sudan	R 5	Wiacek Land (isl.), U.S.S.R.	T 1
Netherlands	P 3	Rangoon (cap.), Burma	A 5	Suez (canal), Egypt	R 4	Windhoek (cap.), Namibia	P 7
Nieuwden, Argentina	L 7	Rawson, Argentina	L 8	Sumatra (isl.), Indonesia	A 5	Winnipeg, Canada	K 3
New Caledonia (isl.)	E 7	Recife, Brazil	N 6	Sunda (isls.), Indonesia	A 6	Wrangel (island), U.S.S.R.	E 2
Newcastle, Australia	D 7	Red (sea)	R 4	Suriname	M 5	Wuhan, China	B 4
New Delhi (cap.), India	T 4	Régina, Canada	J 3	Svalbard (Spitsbergen) (isls.), Norway	P 1	Xinjiang (reg.), China	U 3
Newfoundland (isl.), Canada	M 3	Réunion (isl.)	T 7	Sverdlovsk, U.S.S.R.	T 3	Yakutsk, U.S.S.R.	C 2
New Guinea (isl.)	D 6	Revillagigedo (isls.) Mexico	H 5	Sverdrup (isls.), Canada	K 2	Yana (river), U.S.S.R.	C 2
New Orleans, U.S.	K 4	Rio de Janeiro, Brazil	M 7	Swaziland	R 7	Yaoundé (cap.), Cameroon	P 5
New Siberian (isls.) U.S.S.R.	D 2	Rio Grande (river), North America	J 4	Sweden	P 2	Yellow (sea), Asia	S 5
New York, U.S.	L 3	Riyadh (cap.) Saudi Arabia	S 4	Switzerland	P 3	Yemen	C 4
New Zealand	E 8	Rockhampton, Australia	D 7	Sydney, Australia	D 7	Yenisei (river), U.S.S.R.	D 4
Niamey (cap.), Niger	P 5	Rodrigues (isl.) Mauritius	T 6	Syr (river) U.S.S.R.	T 3	Yokohama, Japan	D 6
Nicaragua	K 5	Romania	R 3	Syria	R 4	York (cape), Australia	P 3
Niger	P 5	Rome (cap.), Italy	P 3	Tabuهران (isl.)	F 5	Yugoslavia	G 3
Niger (river), Africa	O 4	Rosario, Argentina	L 7	Tahiti (isl.), Fr. Polynesia	G 6	Yukon (river), North America	G 3
Nigeria	P 5	Rostov, U.S.S.R.	S 3	Taimyr (pen.), U.S.S.R.	B 2	Zaire	R 6
Nile (river), Africa	R 5					Zambia	R 6
Noma, U.S.	P 2					Zimbabwe	R 7
Norfolk, U.S.	L 4						
Norfolk (isl.), Australia	E 7						



Siberia. These belts contain many individual ranges and are broken in places by lowland passages. See also MOUNTAINS; LAND BRIDGES ACROSS THE OCEANS.

Enclosed within the mountains, flanking them, or lying somewhat removed from them are the world's major plateaus, relatively high and smooth surfaced in contrast to the steeply sloped mountains. In Asia, the Tibetan, Iranian, and Anatolian plateaus are all nearly enclosed by mountains; the Deccan of India and the Arabian Plateau lie close to mountains rather than within them. So much of Africa is tableland that it is often called a continental plateau. In western North America, plateaus occupy the area between the Pacific coastal mountains and the Rockies, and between the eastern and western sierras of Mexico. In South America, much of Brazil and Uruguay is plateau, as is southern Argentina. Antarctica and Greenland are essentially plateaus of ice. See also PLATEAU.

Plains are low-lying, nearly level tracts of land—the most productive and most densely peopled parts of the world. Between the higher and rougher lands of eastern and western North America, plains reach from the Arctic to the Gulf of Mexico, with eastward extensions to the lowland of the St. Lawrence Valley and along the southeastern coast northward to New York. In South America, a narrow plain reaches up the Amazon and, widening, extends southward between the Andes and the Brazilian Plateau into northern Argentina. A third extensive plain stretches from western Europe eastward, widening into central Siberia. Many smaller plains occupy areas between mountain and plateau, fill hollows on plateau surfaces, or occur as coastal fringes. See also PLAIN.

Hills are rough lands, less high and less rugged than mountains. They occur primarily along mountain and plateau fringes, or as remnants of long-eroded mountains or plateaus of the geologic past. In a sense, they form the "filler" between other major landforms.

See also PHYSIOGRAPHY.

**Rocks, Minerals, and Soils.**—The earth's crust is composed of rocks, all of which are composed of minerals. These in turn are composed of chemical elements, either singly or in combination. The three major rock types are igneous, sedimentary, and metamorphic. Igneous rocks have crystallized from a molten or partially molten mass. Sedimentary rocks are composed of particles accumulated by erosion and deposition, and are usually laid down in ocean basins. Metamorphic rocks are those that have undergone a marked change from their original state, as a result of heat and pressure or the action of underground water.

Rocks exposed to the atmosphere are weathered and eroded. Weathering is the natural breaking up of rocks either physically or chemically. As finer and finer particles are produced, the formation of soil begins. Water sinking into the ground performs two major actions: leaching and eluviation. Leaching is a chemical action: soluble minerals are dissolved from the upper part of the rock debris and carried downward, to be re-deposited or carried away by underground seepage. Eluviation is a physical action: very fine mineral particles are carried downward from the surface layer. These processes, over long periods of time, create a surface layer which is coarse textured and poor in soluble minerals, and a lower layer, compact and relatively rich in minerals.

Another element in soil formation is the accumulation at the surface of organic matter from plants and animals. This deposit, in partially decomposed form, is carried downward, providing an organic element in the soil.

After a long period of development, soil reflects climate rather than the type of rock from which it was produced. There are, thus, soil zones similar to climatic zones. Local departures from the broad pattern occur in places where normal soil formation is interrupted or is incomplete.

See also GEOLOGY; MINERAL WEALTH OF THE WORLD; MINERALOGY; ROCKS; SOIL.

**Water.**—Man's use of the world's lands depends in major degree upon the availability of water for domestic use, industry, irrigation, power development, transportation, production of food and raw materials, and recreation. Rivers and lakes provide water for all of these needs; underground water adds materially for some.

When precipitation occurs, part is reevaporated, part runs off the surface, and part sinks into the ground. Reevaporated water maintains some of the vapor content of the atmosphere, from which all precipitation is derived. That which runs off the surface forms rivers and lakes. That which sinks into the ground maintains a water reservoir for plants and man.

Water moves downward into the earth's crust under the influence of gravity, filling spaces between rock particles and cracks and fissures in bedrock, to become groundwater. Where all the spaces are filled is the zone of saturation. The top of this zone is the water table, which follows approximately the profile of the land above it, closer to the surface in low places and deeper below in high places. It is closer to the surface in humid than in dry areas. Where the water table intersects the surface, springs are formed. In surface hollows, swamps or lakes may develop. By digging from the surface to intersect the water table, wells may be made. Between the water table and the surface is a zone in which the spaces are alternately wet and nearly dry. Water in this zone provides moisture for plants.

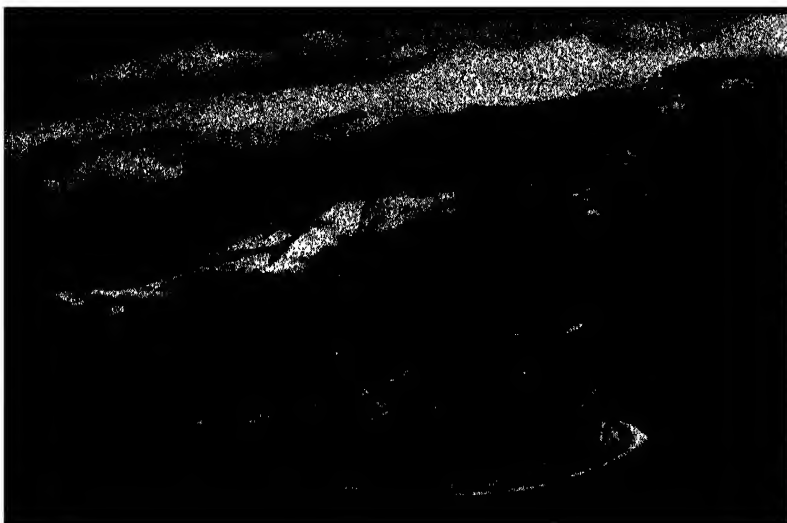
Artesian water differs from ordinary groundwater. It is water trapped in a dipping coarse-textured rock layer which is capped by an impervious layer. Water soaking into the porous layer where it is exposed at the surface builds up pressure because the impervious capping layer prevents escape. When a break is made in the impervious layer, pressure forces water to or toward the surface. See also ARTESIAN WELLS.

The abundance or paucity of available water is closely related to climate except for artesian systems. In humid climates, streams and lakes are numerous, and groundwater is usually plentiful; in dry climates the reverse is true.

See also HYDROLOGY; LAKE; RIVERS; WATER SUPPLY; WATERWAYS OF THE WORLD.

**Major Geographical Regions.**—The concept of geographical regions arises as an attempt to "leave together" those features which actually occur in combination, giving a distinctive quality to each part of the world. A geographical region is an area in which there is some conspicuous unity of environment, resting either predominantly on one element or on a combination of several. This does not mean that the distribution of environmental elements is exactly uniform throughout a given region. It does mean that there is a coincidence or strong correspondence in the distribution of most of the elements, and that there is an extensive core





The contour of the valley floor determined the path this road would follow in east-central Mexico.

American Airlines

area within which the similarities are greater than the differences. Names of regions usually reflect the dominant element.

There are many schemes of world regional division. All have certain similarities; none can be considered final and unalterable. Because of the variety that exists and the changes that constantly take place in both physical and biological elements, rigid categorization is neither accurate nor desirable. One of the most usable schemes is that proposed by Preston E. James, who identifies the following types of broadly similar landscapes: dry lands, tropical forest lands, mediterranean scrub forest lands, mid-latitude mixed forest lands, grasslands, boreal forest lands, polar lands, and mountain lands. The first seven are based primarily on natural vegetation; the last includes all mountainous areas. They offer a framework for observing and describing variety and change throughout the world, and can be subdivided further to express the degree of detail desired.

See also GEOGRAPHY.

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#### BIOLOGICAL ENVIRONMENT

**Flora.**—The flora of the world is highly diversified, varying in its composition according to latitude, altitude, climatic conditions, and past geologic events. The flora of any one area represents the surviving elements of the many plant populations that have followed one another through the various geologic periods. Many different plant formations are recognized on the earth's surface. Only the major ones are considered here. Within any one formation, there may be variations whose appearance is due to special climatic or geologic features.

**Tundra.**—The tundra extends northward from the tree line to the areas of perpetual snow and ice, and is similar in North America, Eurasia, and at higher mountain elevations. Sedges, rushes, lichens, mosses, low-growing shrubs, some grasses, and flowering herbs characterize the tundra. Seed germination is poor, and most plants require several years to produce their first flowers; thus most are perennial, and reproduction by vegetative parts of plants is important. Because of a perpetual cover of ice and snow, very little tundra is found in the Antarctic region. See also TUNDRA.

**Coniferous Forest.**—These forests are largely confined to the Northern Hemisphere and are found across Canada and Eurasia, and at higher

elevations in mountains. The boreal forest of North America extends across southern Canada to the northern Rocky Mountains, north into Alaska, and south into the Appalachians. The principal trees found in these forests are various species of pine, spruce, fir, and hemlock; the composition varies with the latitude, altitude, and other factors. Alder thickets are often found in wet areas, heath shrubs in openings; varying-sized stands of quaking aspen, paper birch, willow, and tamarack are often present. Northward, the forest trees decrease in height and density, and lichens and mosses increase in depth and extent, interspersed with bogs or muskegs. Higher elevations of the Rocky Mountains have spruce, fir, and pine, while the Cascade Range and Sierra Nevada have mountain hemlocks, larch, pine, and red fir. White fir, ponderosa pine, and Douglas fir, are found at lower elevations in the Rocky Mountains. Humid areas of the Pacific slope are characterized by hemlock, Douglas fir, Sitka spruce, and redwood. Eurasian coniferous plants are of the same genera as those of North America, but usually of different species. Most trees are evergreen and carry on photosynthesis even at reduced temperatures.

**Temperate Deciduous Forests.**—These forests have broad-leaved trees that are leafless during the winter and are similar in appearance in North America, western Europe, eastern China, and Japan. Usually they are dense, but where they merge with prairies, savannas with scattered trees or groves are found. Northern areas of the United States have beech, maple, and basswood as the common trees. To the west and south, hickories and oaks predominate. There is a mixed vegetation of basswood, buckeye, and other trees in the Appalachian Plateau. The deciduous forests of Eurasia have different species of the same genera of plants that occur in North America.

**Chaparral.**—Open stands of trees with a growth of grasses or shrubs between are characteristic of this vegetation type. Usually the trees are evergreen and tolerate low moisture. In North America, chaparral extends from California and Arizona southward into Mexico. These areas usually contain many different species of oaks, some of which grow to an enormous size. During the winter, rains are frequent, and the countryside appears quite green. In summer, however, there is little rain, the grasses becoming dry, and fires are a hazard. A similar chaparral formation occurs around the Mediterranean Sea.

**Grassland.**—In all continents where precipitation is low and evaporation high, grassland

occurs. Most grasses are perennial, with leaves originating at the base. Most tolerate grazing well. Important genera of New World grasses include *Andropogon*, the blue stem; *Agropyron*, the wheat grass; *Festuca*, the fescues; and *Buchloe*, buffalo grass. Taller grasses are found where rainfall is greater; short and bunch grasses, in arid areas. Many other herbaceous plants are also found in grassland. In the spring, the prairies are often very colorful because of the many blossoming plants.

**Desert.**—These areas of very low annual precipitation characteristically have widely spaced shrubs, bushes, or cacti, which are often covered with thorns or prickles. The ground between is usually a pavement of soil, gravel, or rock. Desert plants are able to survive long dry periods and to resist desiccation. See also DESERT.

**Tropical Areas.**—The tropics are characterized by a uniform temperature and uniform daylight length throughout the year. Rainfall varies in distribution but is often abundant. The vegetation is a continuum from desert through savanna to tropical deciduous forest and finally to the broad-leaved evergreen or rain forest. The savanna is extensive and has a stratum of herbaceous plants, such as grasses and sedges, with scattered shrubs, trees, or palms. The tropical deciduous forest is leafless during the dry season and has a high, nearly continuous canopy during rainy periods. The broad-leaved evergreen forest is almost completely evergreen and is rich in woody lianas and epiphytes. Seasonal changes are minimal, and at least three strata of trees occur, as well as one of shrubs and giant herbs, and one of low herbs and undershrubs. Tree bases may have buttresses or stilts, and palms and tree ferns are usually found. The variety of species is enormous.

See also ADAPTATION; PLANTS AND PLANT SCIENCE; TREES; TROPICS.

**Fauna.**—The distribution of animals, like that of plants, is dependent upon both climatic and historical factors. Climatic influences include the availability of water, temperature ranges and fluctuations, wind, and relative humidity. Historically, distribution has been influenced by climatic changes, glaciation, geographical changes (mountain formation, or the appearance of land bridges or barriers), and evolutionary changes within the animals themselves.

**Forest Animals.**—Forests offer many habitats to animals. The floor usually has leaf litter, low-growing herbs, and rotting logs, all of which offer niches to small vertebrates and invertebrates. Burrowing forms utilize the soil itself. Above the forest floor is the herb layer, and then the low shrubs. Depending upon the type of forest, there may be one or more layers of trees, at times topped by a canopy of taller trees. The tree covering assures a high moisture content at the floor level and permits the development of a rich fauna of snails, millipedes, centipedes, land isopods, amphipods, arachnids, and amphibians. Tropical areas also have land planarians, crabs, and leeches. Forest reptiles are less effectively adapted to evaporation than are desert reptiles. In North America, mammals of the forest floor include the shrews *Sorex* and *Blarina*, and many rodents, especially of the genus *Peromyscus*. In the tropics of Africa and the Orient, shrews of the genus *Crocidura* are found.

Air currents are mild in forests, and many insects, especially the butterflies, have weak powers

of flight. The mammals utilize their sense of smell less than those of open country, but tend to be noisier, for the sense of hearing is important in maintaining flocks. Sight is not well developed; the forest interferes with vision. Tree growth also impedes rapid locomotion, and forest mammals often have short limbs and wedge-shaped heads. The ungulates have less development of horns and antlers.

The arboreal habit of forest animals is well developed, particularly in the tropics, where climbing animals have powerful claws and often have opposable digits. The hands of monkeys are modified for grasping, and tree-climbing marsupials have the hind feet similarly modified. Frogs and toads have sucking disks, and lizards may have adhesive organs on their feet. Arboreal vipers, some pit vipers, an arboreal mouse of New Guinea, and some kinkajous, tree porcupines, and New World monkeys possess prehensile tails. Many forms have evolved rigid supporting membranes which permit gliding flight. These include lizards (*Draco*), the flying lemur of the Malay region, flying squirrels of North America, and some Australian marsupials.

The forests have an abundance of animals, though they may be difficult to see. The forest margin actually has the greatest number of animals, for the forest serves as a hiding place, and the grasslands supply food.

**Grassland and Desert Animals.**—In these areas, the wind blows strongly, temperature and humidity fluctuations are great, the danger of desiccation is high, and there are few hiding places. Animals of these areas are fitted by both habit and structure to withstand the extremes of the environment. Many forms, including some tortoises, monitor lizards of the genus *Varanus*, some snakes, and many rodents, all form burrows. The burrowing prairie dog (*Cynomys*) of the western United States, members of the genus *Ctenomys* in Patagonia, the piping hares (*Ochotona*) of the Mongolian steppes, and the jumping hares (*Pedetes*) of the South African steppes are all common prairie rodents. Birds tend to nest on the ground; a few, such as the burrowing owl of Uruguay and Guiana, prepare a nesting hole in the ground. The burrowing owl of North American plains inhabits abandoned prairie dog holes.

Both mammals and birds have keen eyesight in open country and rely less on hearing than do their counterparts in forests. Groups rely on sight for keeping together and are less noisy than forest animals. Many desert and grassland animals congregate in groups or herds; the ungulates and ostriches of Africa, the kangaroos of Australia, and the bison of the United States and Canada have this habit. Open-country animals are adapted to running. Some outstanding runners are the zebras, cheetahs, antelopes, and ostriches of Africa and the rheas of South America. Predatory forms, such as the wolves, lions, and cheetahs, are long limbed and capable of sustained running. In Australia, the characteristic grass eaters are the kangaroos, jumping forms with enormously developed hind limbs and tails. Other jumping forms include the African jumping hare and the kangaroo rat of the North American deserts.

Large numbers of grasshopperlike forms are found in grassland. The migratory locusts, which often develop large swarms, occur on all continents. Termites and ants also abound and may form spectacular nests. There are large numbers of reptiles, including snakes, lizards, and turtles;

many feed on insects. The large number of insects and seeds also favors ground feeding by birds. Many birds are adapted to running, and their young are quite mature when hatched. Among mammals, herbivores predominate, and rodents occur in large numbers.

In colder arid regions, snails, insects, spiders, the few reptiles present, and the small mammals become dormant during the cold months. Birds usually migrate southward.

In deserts, animals tend to be pale in color, and they have structural adaptations or habits that help conserve water. They often form burrows, which aid in escaping desiccation. Reptiles are particularly abundant, and running, jumping, and burrowing vertebrates are important in the fauna.

**Northern and Alpine Animals.**—The area above the timberline in mountains is a special environment with difficult terrain, isolation, and storms. A few true alpine forms are the marmot and pika of the Rocky Mountains, the European redstart, and the snowfinch of the Alps. Animals of the polar regions likewise have a difficult climate, with long winters, short summers, and low temperatures. In the north, the springtails are abundant insects on the ice; reptiles and amphibians are few. The warm-blooded animals of polar regions have special heat conservation structures, such as thick layers of fat and heavy coverings of hair or feathers. The polar bear, lemming, hare, musk ox, reindeer, ermine, wolf, and fox are found in Greenland, an Arctic area with a large number of land mammals. Land birds are few, though there often are many marine forms. Smaller birds, geese, and swans are migratory.

**Aquatic Animals.**—Ocean fauna is adapted to life under the varied conditions of different regions. Depending upon the substratum, the intertidal zone provides a habitat for many invertebrates, including some worms, mollusks, sea anemones, starfish, and corals. Below this zone, the shallow parts of the ocean have many varied invertebrates as well as fish. In the great depths, where pressure is high, many bizarre animals dwell, including long, slender fish with gaping jaws, and bottom-dwelling worms, starfish, mollusks, crustaceans, and other invertebrates. Some of these animals produce light by bioluminescence.

Penguins have evolved as a highly specialized life form in order to cope with a generally harsh environment.

U.S. Coast Guard



Inland waters (streams, lakes, ponds, swamps) have many animals. The bottom mud is a home for worms, mollusks, insect larvae, and other small forms. Above the bottom are the microcrustaceans, protozoans, and aquatic insects. Many species of fish also inhabit these waters.

See also **ECOLOGY**; **OCEANOGRAPHY—Biology of the Ocean**; **ZOOGRAPHY**.

**Peoples and Their Distribution.**—Like all organisms, man is subject to the many factors of his physical environment, but because of his cultural development, he tends to react on the environment more strongly than does any other organism. He is structurally, physiologically, and psychologically a highly adaptable form; and even before the establishment of complex types of culture, man had spread into nearly all land communities. The movement into the Americas was slower than that into other areas, but it occurred thousands of years ago.

**Distribution by Race.**—Living men constitute a single species, *Homo sapiens*; thus all human beings possess a similar genetic heritage. Within this single species, there is great biological and cultural diversity. The variation within the species is biologically favorable, for it extends the range of adaptation and is material for progressive changes. Evidence is lacking to prove that any one race or group is inherently or biologically better than any other. It is possible that racial differences originally suited each race better to the area in which it lived, but cultural changes have tended to eliminate this very local superiority.

Groups of human beings are differentiated from one another by hair form, skin color, shape of head, facial features, and stature. They are divided into three main races—Negroids, Mongoloids, and Caucasoids—each of which is considered to have a common ancestry and similar physical characteristics. At present, individuals of these races are found on all continents, but their distribution before 1492 was more restricted. The races have been blended by intermarriage, so that they are not always distinct. Their exact number of subdivisions is uncertain, and classification is difficult.

The Negroids are characterized by their woolly hair and a skin color that varies from yellow through dark brown to black. Most dwelt originally in Africa, but the Negritos of the Philippines, the Malay Peninsula, and Western New Guinea, and the Melanesians found from New Guinea to Fiji and in Micronesia are also members of this race. The Mongoloids usually have straight black hair, little or no facial hair, and a skin color that varies from yellow-white to brown. They probably had their origin in Asia, but migrations that occurred thousands of years ago resulted in the establishment of the populations known as the Indians of North and South America, the Eskimos of North America and northeastern Asia, the Patagonians of southern South America, and the Polynesians found from Hawaii to New Zealand and from Samoa to Easter Island. The Caucasoids tend to have hair that is smooth to wavy and a skin color varying from pinkish-white to brown-black. Originally they were found in Australia, northeastern Asia, India, northeastern Africa, Arabia, Europe, and parts of Russia.

**Distribution by Population.**—The exact site of man's origin is unknown, but fossil evidence indicates that it occurred in the Old World. From his earliest origins, man must have wandered constantly in search of food and shelter or in response

to seasonal and climatic changes. Later, curiosity or a desire for trade may have provided additional motivation. During these many wanderings or even migrations, groups met, intermarried, and drifted gradually into all habitable areas of the earth. Populations that became isolated gradually developed racial and cultural characteristics of their own. The rate of cultural development varied widely in different groups.

The peoples occupying such forbidding areas as portions of the Arctic, the extreme southern regions, and the tundra have a relatively low cultural level. While man is highly adaptable, the stresses of these environments are such that the inhabitants spend all their energies simply to keep alive. Even the coniferous forest formation, with its severe winters, is heavily populated only in its southernmost reaches.

Man has reached his highest development and greatest population density within the deciduous forest zone. Though the climate of the area originally occupied by these forests often has extremes of temperature, they tend to be less severe than those of more northern areas and of the grasslands. The seasonal changes and variable climatic conditions appear to be most favorable for the greatest efficiency of man's activities and his best health and energy.

The grasslands of the world are still, in many areas, occupied by scattered groups, some of which are seminomadic. In the United States, many large cities and the most productive food-growing areas are found in this formation, but this development has been made possible only by modern technology. Formerly, the grasslands offered nearly insurmountable problems for habitation. Swarms of biting insects attacked people, there was not always sufficient water, and building materials were lacking.

In general, the tropics are only sparsely settled, by peoples who often have a low level of culture. Malaria, hookworm, and skin parasites still present great health problems, and large populations are found in the tropics only in those areas where the many diseases have been somewhat controlled. At the time of the arrival of white men in Central and South America, two native cultures were flourishing: the Incan, chiefly in the invigorating climate of the Andean Highlands; and the Mayan, which had its origin in the rain forests of Central America. Remarkable cultures also flourished in the tropics of southeast Asia. These civilizations, however, were exceptions to the general picture of only scattered populations in the equatorial belt.

The arid regions of the world likewise have been relatively unpopulated until the development of modern technology. Even now, except where irrigation makes agriculture possible, the arid regions are occupied only by nomadic peoples who often are of a low cultural level.

See also ANTHROPOLOGY; POPULATION; RACE—*The Problem of Racial Origins*.

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**WORLD BANK.** See under INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT. See also BANKS AND BANKING—*World Bank*.

**WORLD COUNCIL OF CHURCHES**, an international association of over 250 major churches, Protestant, Anglican, and Eastern Orthodox, in all the continents. Its purpose is to foster cooperation and greater unity among all churches of the world. Its activities embrace major common concerns, including worship, evangelism, education, social and interracial justice, and international understanding and peace. An important function is mutual aid on a worldwide scale. Its work is administered in three divisions: Faith and Witness, Justice and Service, Education and Communication.

Officially inaugurated at an assembly in Amsterdam, Aug. 22 to Sept. 4, 1948, it was the outgrowth of several earlier international gatherings in the interest of cooperation and unity among the churches, especially the Oxford Conference on Christian Life and Work and the Edinburgh Conference on Faith and Order, both in 1937. In the next decade a "Provisional Committee for the World Council of Churches" laid the groundwork.

For several years the European and North American members exercised a dominant influence, but after the third assembly, held in New Delhi in 1961, the participation of the Asian, African, and Latin American churches became greater, and churches in the Soviet orbit joined. Although the Roman Catholic Church is not a member of the council, its relations with the World Council have been increasingly cooperative, especially since the Second Vatican Council in 1962-1965, and a "joint working group" meets regularly. Member denominations send delegates to a plenary assembly about every five years. A central committee of about 100 meets annually. A small executive committee oversees day-to-day operations of the permanent secretariat in Geneva.

SAMUEL MCCREA CAVERT  
Author of *"On the Road to Christian Unity"*

**WORLD COURT.** See INTERNATIONAL COURT OF JUSTICE.

**WORLD GOVERNMENT.** Strictly speaking, the concept of a world government could not arise until some two centuries after the great discoveries of the 15th century and the spread of trade and settlement had produced the world we know today. But since the problem of world government is essentially that of bringing together in one state a number of independent or "sovereign" states, that is, the process of political integration, the known past of this process is helpful in the understanding of the contemporary problem of political integration of the whole world. In the historic past the process has often resulted in the formation of larger political units from numerous smaller ones; the great seal of the United States sums it up neatly: *e pluribus unum*, from many one. Purely for purposes of analysis, one may distinguish one extreme of integration by force or conquest, and another of integration by consent, the first known briefly as imperialism, the second as federalism. The historical record from the beginnings of civilization in the Middle East, India, and China 4,000 to 5,000 years ago rarely shows integration by either imperialism or federalism in their pure logical extremes. Successful empires in part initiated by conquest, like the greatest and most successful in our Western civilization, the Roman Empire, have been held together by at least the tacit consent of conquered peoples. Such spectacular conquests as those of the Huns and Mongols are, in terms of true integration, superficial and ephemeral. Permanent rule based on conquest alone is hardly to be achieved save by the annihilation of the conquered and usually very primitive population, as in Australia and in the United States east of the Mississippi. On the other hand, union by consent alone is also rare; federalism in pure form has triumphed most notably in such countries as the United States and Switzerland, and in a sense in the association of the (British) Commonwealth of Nations.

**Modern Theory and Practice.** In modern times, planning for wider union of independent states by some form of consent goes back to such vague plans for some alternative to warfare as the "Great Design" of Henry IV of France (r. 1589-1610) and his minister, the duc de Sully, and continues, through the writings of the Abbé de St. Pierre and others in the 18th century on down to such contemporary American planners of world government as Grenville Clark, or of Atlantic Union, such as Clarence K. Streit. This body of writings forms a by-no-means unimportant part of the history of political theory and, like all such theory, has some effect on the course of events. World government, if it does come, will owe much to this long line of theorists.

In practice, over the last four centuries, two sorts of efforts at more extensive political integration, corresponding to the previous analysis, may be distinguished: those aiming at conquest and those aiming at voluntary union. Within an increasingly wide-flung network of states having organized international relations—now literally covering the whole world—certain preponderant states have at various times attempted what in rhetoric was often called "world conquest." The Habsburgs under Charles V and Spain under Philip II in the 16th century; France under Louis XIV in the 17th and early 18th centuries, and under Napoleon in the late 18th and early 19th centuries; Germany under William II and Adolf Hitler in the 20th century—all made more or less definite attempts to break down the European

and world system of "sovereign" states in balance of power. None of them succeeded; nor was the less aggressive (at least as far as Europe was concerned) preponderance of Victorian Britain anything like world government. Napoleon and Hitler came closest to building a new order by conquest, but neither built permanently. Nonetheless, it is likely that the future historian will record that even these fugitive experiences with wider governing units, including "spheres of influence" and "satellites," have played a part in preparing mankind for political integration on a world-wide basis.

Specific attempts at wider peaceful cooperation by consent among states have come, not without the influence of war-wearied public opinion, at the end of each one of the half dozen or so world wars of modern times. The series shows an unmistakable progress toward more extensive and more effective voluntary union. After the Treaty of Utrecht in 1713 the great powers, having defeated Louis XIV of France, set up an alliance system specifically aimed at preserving the peace and held two congresses which at least helped delay outbreak of war. After the Congress of Vienna in 1815, the powers victorious over Napoleon, with France included, set up a similar alliance and congress system, backed up by the idealistic document called the Holy Alliance—a system which again helped to prevent a general war until 1914. In 1919 the Treaty of Versailles set up a League of Nations with headquarters at Geneva, Switzerland, with a formal charter, its own civil servants, and various functional organs. The League failed to keep the peace challenged by the Axis powers 20 years later, but even before the final defeat of those powers in World War II, a new and stronger league was set up at San Francisco in 1945. This United Nations (UN) organization, with headquarters in New York City and functional branches in Geneva and Paris, had 111 members in June 1963, including both the rival superpowers, the United States and the USSR. Of regional unions, the European Economic Community is a real union in the sense that it limits the sovereignty of its members on specific matters. Even the Organization of American States, though it does not directly limit the sovereignty of its members, is a much tighter group than the old-fashioned classic alliance. The same is no doubt also true of the Soviet satellite system in Europe.

**United Nations.** The UN is not a true government in the sense of possessing sovereignty over the individual citizens of its member states. Nor can it levy taxes and raise armed forces from an unwilling government of a member state. It has, however, its own armed forces and its own income raised voluntarily from its members. The Charter provides (Article 19) that a member-state not paying its regular assessments may lose its vote in the General Assembly. Certain member-states have refused to pay special assessments levied for purposes they disapproved—for example, the sending of a United Nations army to Katanga in the Congo in 1961—but the Charter contains no provision for penalties in such cases.

Attempts at some kind of ordered international politics that will keep the peace, in a way that the classic alliances and balance of power system did not, have been progressively more and more deliberate, sweeping, and in a sense successful. It would be rash to prophesy an effective world government in the near future, but it would



equally be shortsighted to maintain that no such government is possible. On the contrary, the precedents point clearly, assuming no catastrophic destruction of civilization, to the establishment of some form of organized world government possessing the necessary police and financial powers, and it is not inconceivable that the United Nations will develop into such a government.

See also CONCERT OF EUROPE; HOLY ALLIANCE; INTERNATIONAL COURT OF JUSTICE; INTERNATIONAL LAW; LEAGUE OF NATIONS; ORGANIZATION OF AMERICAN STATES; PAN AMERICAN UNION; UNITED NATIONS.

CRANE BRINTON, Author of *"Ideas and Men: The Story of Western Thought"*

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**WORLD HEALTH ORGANIZATION (WHO)**, a specialized agency of the United Nations, with headquarters at Geneva, Switzerland. It came into official existence on April 7, 1948, when its constitution had been ratified by 26 member states of the United Nations. It acts as the directing and coordinating authority on international health work; its aim is the attainment by all peoples of the highest possible level of health.

**Work of the Organization.** WHO provides to national governments, on request, advice and practical assistance in strengthening national health services; training doctors and health workers; controlling or eradicating such major diseases as malaria, yaws, tuberculosis, and leprosy; protecting the health of mothers and children; improving sanitation and water supply; and promoting mental health. As of 1962, 143 countries and territories were receiving direct help from WHO. Permanent services to all member states include a daily epidemic information broadcast; the establishment of international quarantine regulations; setting international standards for drugs, vaccines, and other biological substances; the promotion of medical research in certain fields; and the exchange of information through seminars, publications, and other media.

**Organs and Staff.** The governing body is the World Health Assembly, composed of delegations from all member states. It meets once a year, usually at Geneva, but occasionally elsewhere if invited by a member government. It alone decides the policies, program, and budget of the organization. The assembly chooses the countries entitled to designate one member each on the 24-man Executive Board, which meets twice a year, scrutinizes the program and budget proposed by the director general for the succeeding year, carries out investigations and surveys requested by the assembly, and reports to that body. The director general is responsible for the day-to-day

work of the organization. He appoints the staff of about 2,000 working at the Geneva headquarters, in the regional offices, and in the field projects. Six regional organizations—each composed of a regional committee, on which all governments in the region are represented, and of a regional office—are responsible for the conduct of the organization's work in Europe, the Americas, Africa, the eastern Mediterranean, Southeast Asia, and the western Pacific. The regional offices are situated in Copenhagen, Washington, Brazzaville, Alexandria, New Delhi, and Manila, respectively, for the areas indicated.

**Membership and Resources.** Membership in the organization is open to all states. It increased from 56 member states in 1948 to 151 in 1980, plus two associate members (countries not responsible for the conduct of their own international relations). The regular budget is contributed directly to WHO by its member states. Other financial resources include two funds consisting of voluntary contributions, one for malaria eradication and the other for health promotion; and the United Nations Fund for Technical Assistance to Underdeveloped Countries, of which a substantial part is employed for health work. In addition, the United Nations Children's Fund (UNICEF) assists numerous international health projects by contributing supplies and materials.

See also HEALTH EDUCATION; PUBLIC HEALTH.

KENNETH GRINLING

*Division of Public Information, WHO*

**WORLD SERIES**, in major league baseball, a championship tournament played by the pennant winners of the National League and the American League. Seven games are scheduled, and the team that wins four games is the champion. First played in 1903, the series has been an annual event since 1905. Beginning in 1969, when each league was expanded into East and West divisions, a League Championship Series has been held between the winners of each division to decide the contenders in the World Series.

Medical specialists from many nations have volunteered to work for the World Health Organization.





## WORLD WAR I

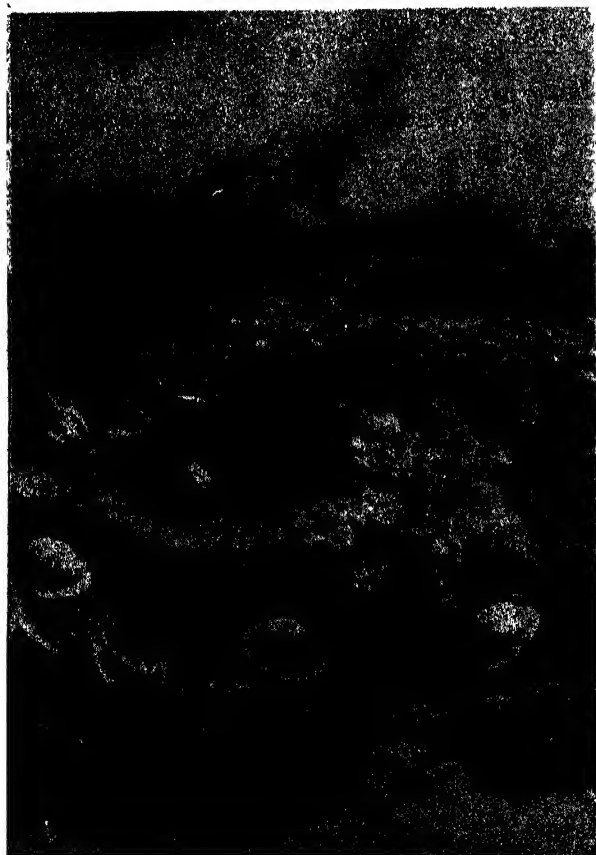
**WORLD WAR I**, the name commonly given to the war of 1914–1918, which began in Europe and was fought principally on that continent but eventually involved all the continents of the world. While the wars between Great Britain and France from 1689 to 1815 had been extended to North America, Africa, and Asia, they remained wars between European governments. The term “world war” is properly applied to the conflict of 1914–1918 because the various parts of the British Empire in all continents as well as many countries in Asia and North and South America participated in it. For the first time, all the great powers of the world were engaged: Austria-Hungary, France, Germany, Great Britain, Italy, and Russia in Europe; Japan in Asia; and the United States in North America. It is estimated that by the end of the war about 93 percent of the population of the world was in greater or less degree involved.

The causes of World War I, its military operations, diplomacy, costs, and aftermath are discussed under the following headings:

- |   |                                     |
|---|-------------------------------------|
| 1. General Survey                             | 10. Colonial and Japanese Campaigns |
| 2. Prelude to War                             | 11. Turkish Campaigns               |
| 3. War Declared                               | 12. Balkan Campaigns                |
| 4. Comparative Strength of Belligerents       | 13. The War at Sea                  |
| 5. Western Front: 1914—Invasion and the Marne | 14. The War in the Air              |
| 6. Western Front: 1915—1917—Stalemate         | 15. Diplomatic History of the War   |
| 7. Western Front: 1918—The Year of Decision   | 16. The Postwar World               |
| 8. Eastern Front                              | 17. Chronology                      |
| 9. Italian Front                              | 18. Costs of the War                |
|   | 19. War Casualties                  |
|   | 20. Bibliography                    |

### 1. General Survey

At the time World War I broke out, no general war had been fought in Europe since 1815.



U.S. War Dept. General Staff

British soldiers near Zillebeke, Flanders, on Sept. 22, 1917, during the Battle of Menin (Menin) Road Ridge (part of the Third Battle of Ypres).



EUROPE IN 1923

There had been many revolts as well as a number of short wars, the latter being fought mostly with small professional armies, which did not seriously affect the life of the countries involved; the casualties were not excessive. Among these were the three wars that occurred between Russia and Turkey (1828-1829; 1853-1856—the Crimean War; 1877-1878); and three wars among the Balkan states (Serbia and Bulgaria, 1885-1886; Greece and Turkey, 1897; Balkan states and Turkey, 1912-1913). Three wars with Austria were required for the unification of Italy (1848-1849; 1859; 1866); and three wars were also needed for the unification of Germany (1864; 1866; 1870-1871). The Russo-Japanese War lasted somewhat longer than most of these conflicts, from February 1904 to September 1905; it came to an end because Japan had run out of money, and Russia was faced with revolution. There had also been such international conflicts as the Spanish-American War of 1898 and the South African (Boer) War of 1899-1902.

The most destructive war of the 19th century was the American Civil War of 1861-1865, which cost the lives of considerably more than half a million soldiers (out of a population of less than 32 million) and stopped only when the South was completely exhausted. From a military point of view, it was the first modern war. Railways were used extensively for the transport of troops and supplies, and communications were maintained by military telegraphs. Rifled cannon replaced the conventional smoothbore guns; breech-loading repeating rifles firing metallic cartridges took the place of muzzle-loading muskets. Machine guns, wire entanglements, hand grenades, land mines, and trenches proved themselves formidable in defense, as was shown by the Confederate Army in front of Richmond. Observation of the battlefield was undertaken by balloons, and signaling by flags and lamps was

highly developed. At sea the first duels were fought between ironclads. But European observers were not impressed by the volunteer, essentially civilian armies which fought the war; the chief of the Prussian General Staff, Field Marshal Count Helmuth von Moltke, referred to them as "armed mobs chasing each other around the country, from whom nothing could be learned." As Lynn Montross points out in *War Through the Ages* (3d ed., pp. 590-592, New York 1960), while the generalship of Thomas J. (Stonewall) Jackson may have been much admired, European students of war did not deduce from the American experience that modern weapons gave the defensive a strong advantage over the offensive, and that a war fought with all the resources of modern industry would be a long-drawn-out affair.

In the century after Waterloo, Europe had been transformed politically by the universal adoption of constitutional governments (even Russia and Turkey had parliaments) and by the widespread, though not universal, provision for manhood suffrage. In greater or less degree all governments were responsive to public opinion, and they could hope to wage war successfully only if they enjoyed popular support.

During this same period the economy of Europe was transformed even more by the Industrial Revolution—that is, by the use of iron and steel in the manufacture of machines and the use of the steam engine (and later electricity) to provide power for operating the machines. By 1914 the machine age had spread to Russia, though not on so extensive a scale as in western Europe. An important accompaniment of this economic revolution was the enormous increase in population: that of the British Isles, for example, rose from 15 million in 1815 to 45 million in 1914; that of Germany, from 25 million to 65 million; and that of Russia (including Russian Poland and Finland), from 45

million to 178 million. These millions could be fed only by vastly improving the methods of agriculture or by importing food. From the military point of view, much larger armies could be raised than in previous ages and, after the Franco-Prussian War of 1870-1871, which seemed to demonstrate the superiority of the German armies raised by conscription, the principle of universal military service was adopted by all the Continental great powers. Every able-bodied man was required to serve a period of years with the colors; after this active service he passed into the reserves, but he could be recalled to arms in the event of war. In 1914 the standing armies of France and Germany totaled about 800,000 men each. Including trained reserves, France had 4,017,000 men and was able during the war to mobilize another 4,393,000; the corresponding figures for Germany were 4,500,000 and 6,500,000, respectively. The numbers in proportion to total population were lower in Italy, Austria-Hungary, and Russia, while Great Britain, which had not yet adopted conscription, maintained a small volunteer army and had no system of reserves except for retired soldiers.

When war came in 1914, mobilization was ordered instantly. The war was fought by the entire manhood of the belligerent countries. Although the levy en masse had been employed to a considerable extent during the wars of the French Revolution and the Napoleonic period, the effect on national life was nothing like what took place from 1914 to 1918. In the earlier conflicts industry in the modern sense hardly existed, and the peasants were able to supply enough food for both armies and civil populations. In World War I the withdrawal of millions of men from agriculture and industry greatly reduced production. At all costs the soldiers had to be fed, clothed, and armed. As the war progressed, the state was forced increasingly to take over the management of the national economy. After the armies had been supplied with what they needed, what was left of both food and manufactured goods was rationed to the civilian population, which, as time went on, suffered privations of all kinds. The war, in short, became an all-out effort not only on the part of the military forces, but on that of the civilian front as well.

From a technical point of view, World War I was the war of the internal combustion engine, which was used in the trucks that conveyed troops and supplies from railheads to the front; and in airplanes, tanks, and submarines, all of which were employed on a practical basis for the first time. Another technical innovation was wireless telegraphy, which was used at sea to communicate with ships and on land to transmit orders.

In Russia morale collapsed in 1917, and revolution resulted. In Germany and Austria-Hungary morale did not break until the armies were defeated in the field, but the fighting qualities of the armies deteriorated in 1918, as supplies at the front ran short and the soldiers learned of the ever-growing distress at home. If Britain, France, and Italy were able to hold out until victory had been won, it was because they received help on an enormous scale from the United States for both military and civilian needs. (This help was made possible through the defeat of the German submarine campaign by the adoption of the convoy system.) Thus the war was not a mere contest of governments,

but a struggle of peoples.

Each people entered the conflict with a deep conviction that it had been attacked by its enemies, and this conviction helped to keep up the courage necessary to see the war through. Not only must the enemy be thoroughly beaten, but guarantees must be obtained that he could never repeat his aggression. Furthermore, instead of the short war that was generally expected, the struggle lengthened into years and the casualties became almost unbearable, so that both governments and peoples came to feel that the terms of peace to be imposed on the defeated enemy must be extremely harsh. In December 1916, during a lull in military operations, Germany and its allies proposed peace discussions; Britain, France, and their allies not only refused any discussion, but in January 1917 announced terms of peace that could be realized only if the other side were completely defeated. Germany's terms, which were not made public but were communicated to the president of the United States, were equally severe. The few voices that were raised then and later in favor of a compromise peace got no hearing. The war had to continue until victory was won. Early in 1917 the fabric of European society had not been severely shaken; the emperors of Germany, Austria-Hungary, and Russia and the sultan of Turkey still sat on their thrones. The world would probably have been spared much agony if peace could have been made at that time, but psychologically this was impossible.

So the war continued until the end of 1918, bringing in its train the Communist revolution in Russia and the overthrow of monarchy in Austria-Hungary and Germany. Not only did the house of Habsburg lose its throne, but the territory of Austria-Hungary was divided among six states consisting of the principal peoples that had been held together in the monarchy for several centuries: German, Magyar, Polish, Czechoslovak, Yugoslav, and Rumanian. When peace was made after the war, the new states were recognized by the victorious Allies. This doctrine of self-determination was also applied in the areas in western Russia that split off after the Communist revolution. The most important single consequence of the war was probably the recognition of the principle of nationality on the broadest possible scale. For the first time in European history, almost every people in Europe was able to establish an independent government and a unified state. In most cases, it was not possible to draw frontiers without leaving minorities on the wrong side of the line, but the number of such minorities after the war was much smaller than it had been before 1914. The establishment of the succession states of Austria-Hungary has often been criticized on the ground that they replaced the much larger economic unit of the former state, but except in minor details the arrangements made in 1919 survived World War II and, historically speaking, appear to have justified themselves.

Since the democratic parties had won the war, the world had supposedly been "made safe for democracy," as President Woodrow Wilson put it, and after the war a democratic form of government was adopted in Germany and in most of the countries of central and eastern Europe. By the 1930's, however, this experiment had failed, and the new democracies, with the exception of Czechoslovakia, had gone over to

fascism, nazism, or some other form of autocracy or totalitarianism. This came about because Europe had never recovered from the terrible losses of the war. Before 1914 the European economy was based on the gold standard and on an almost complete freedom to export and import goods except as limited by tariffs. The war almost completely destroyed this system, which was replaced by managed currencies and by all kinds of governmental regulations. While a superficial recovery took place in the 1920's, it depended on American loans, by means of which such reparations as were paid were financed; when these loans dried up as a result of the great depression in the United States, European prosperity also collapsed.

Apart from the material destruction caused by the war in many parts of Europe, the human losses—at least 10 million men were killed or missing, and many millions more were wounded—could never be made good. Not since the Thirty Years' War in the 17th century had Europe passed through such suffering and horror as in the years 1914–1918. So it was hoped that World War I had taught mankind a lesson; those who suffered through it little dreamed that two decades later a second and even more terrible world war would take place.

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## 2. Prelude to War

World War I began suddenly and unexpectedly in July 1914 as a result of the murder of Archduke Francis Ferdinand, heir to the throne of Austria-Hungary, which took place on June 28 at Sarajevo, Bosnia. Since no war involving all of the six great powers of Europe had occurred since 1815, the possibility of a general war had generally been discounted, at least by ordinary persons. Although in the winter of 1912–1913 the small Balkan states had staged a successful war against Turkey, almost expelling the latter from Europe, and then fought among themselves, the great powers had kept the peace. Questions concerning the new state of Albania and the islands of the Aegean Sea remained unsettled in the spring of 1914, but it was generally assumed that another Balkan crisis would result in another compromise. Statesmen in all countries were in the habit of proclaiming their devotion to peace, and perhaps believed their professions. Few persons in any country were psychologically prepared for the catastrophe of a general war, for while there had been many British, French, German, Italian, and Russian predictions of impending disaster, they had commanded little attention.

The reason for this indifference was the widespread belief, at least in the democratic countries of Europe, that modern governments were too enlightened to go to war. In 1910, Norman Angell, a Briton who, after some years in the United States, had spent most of his life on the Continent, published a book called *The Great Illusion*, which caused a sensation. Angell said bluntly that wars did not pay. Modern economic life, he argued, was a highly complicated affair and depended on mutual confidence between nations and on an elaborate system of international credit, both of which would be destroyed by war. If governments were so foolish as to go to war, they would lose much more than they

could gain, and the victors would be ruined as well as the vanquished. Angell's thesis was by no means universally accepted, particularly in Germany, but the opinion was often expressed that war was much too expensive for governments to contemplate, and that, if any government did so, it would be stopped by financial pressure. And it was a fact that in July 1914 the strongest opposition to war came from bankers in England and Germany.

In all European countries the Socialist parties, which were growing more powerful with each election, were in principle opposed to war, and they championed the idea that the workers should not respond to an order of mobilization. Moreover, there were many persons who hoped that somehow the influence of the Christian churches, especially that of the Roman Catholic Church, would be thrown into the scale against war.

**Underlying Causes of the War.**—When, on July 23, 1914, Austria-Hungary accused Serbia of responsibility for the murder of the archduke and made demands that seemed to foreshadow military action, the illusions of pacifism vanished overnight, and the citizens of all countries who before Sarajevo had had no thoughts of war accepted it as something unavoidable. Men then began to ask themselves how the war had come about, distinguishing between the immediate antecedents and the deeper roots. A popular explanation was that it had been caused by economic jealousies and rival imperialisms. Thus for 25 years Germany had been challenging the century-old commercial supremacy of Great Britain; Germany, it was argued, was pushing Britain to the wall, and Britain had gone to war to destroy German competition. Then there were the rivalries between Britain, France, Germany, and Russia in the Balkans, Africa, and Asia that more than once had brought them to the brink of war; and along with the activities of governments went the intrigues of high finance in all parts of the world to obtain concessions for railways, canals, oil wells, and other profitable enterprises. This explanation of the "international anarchy" was championed by socialists, who derived their ideas from Karl Marx, but it was not exclusive with them; on the very eve of the war in 1914, Henry Noel Brailsford, an English radical, published a book entitled *The War of Steel and Gold* that said much the same thing.

Undoubtedly economic interests and rivalries played a considerable part in creating international tensions in the 43 years between the Treaty of Frankfurt, which closed the Franco-Prussian War, and the outbreak of World War I. The dispute between Austria-Hungary and Serbia, which set off the explosion, was greatly envenomed when Austria sought to control Serbia by harsh commercial treaties and by the imposition of severe sanitary legislation against the importation of Serbian livestock (the so-called Pig War, which began in 1905). A long tariff war (1888–1898) embittered the relations between France and Italy. In colonial matters there were such sharp conflicts as those between Britain and Russia in Persia (Iran), between France and Italy in Tunisia, between Germany and France in Morocco, between Britain and France in Egypt, and between Britain and Germany in Africa. More than once war seemed imminent. Likewise the project of building a



railway from Constantinople (Istanbul) to Baghdad and the Persian Gulf, the Baghdad Railway (q.v.), which was the most famous undertaking of financial imperialism, involved Britain, Germany, France, and Russia in years of bitter wrangling. In consequence of these rivalries for colonies and the competition for concessions, all the governments built up their navies, which seemed necessary for the protection and expansion of their interests overseas. The naval rivalry between Germany and Britain became the most important single factor in their antagonism.

Yet economic interests, in the usual meaning of that phrase, had little to do with the outbreak of war in 1914. The trade rivalry between Britain and Germany, which had been so much advertised 10 years before, was easing off because the two countries were increasingly developing their markets in different parts of the world—Britain within its own empire, and Germany on the continent of Europe. In the spring of 1914 the various powers interested in the Baghdad Railway arrived at a compromise which seemed to ensure the completion of the line, and at the same time they divided the Ottoman Empire in Asia into spheres of economic influence for the laudable purpose of avoiding war over the Turkish succession.

On the colonial side the great powers were able to partition Africa without recourse to war. The British fought the Afrikaners (Boers) in South Africa, and British, French, Germans, and Italians fought native peoples throughout the continent, but the Europeans did not fight one another. In the spring of 1914, Britain and Germany were ready to sign an agreement concerning the ultimate disposition of the Portuguese colonies in Africa. Instead of going to war over Persia, Britain and Russia had divided it into zones of economic exploitation. To be sure, Japan and Russia had fought a serious war over Korea and Manchuria, but it may be said that by 1914 the economic rivalries and colonial disputes that loomed so large in the first decade of the 20th century had greatly diminished, and they played no part in the negotiations which immediately preceded the war.

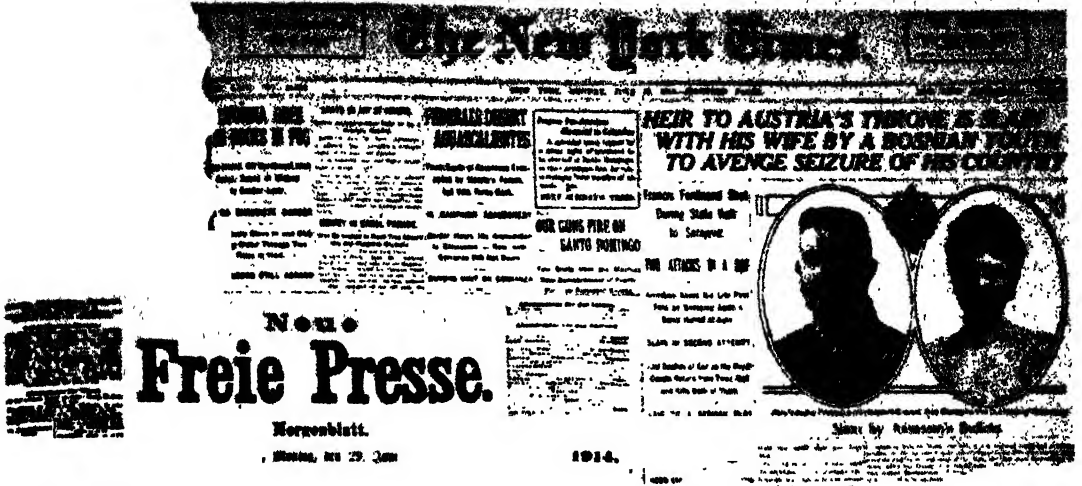
But if strictly economic questions were of small importance in bringing on the war, that could not be said of problems of strategy and military power and national prestige because of the German enigma. Germany was the most restless nation in Europe. Its population, industry, and foreign trade were growing more rapidly than those of any other European country, and it had become the second industrial and commercial nation of Europe, with every prospect of becoming the leader and thereby upsetting the balance of power. The Germans did not, however, feel sure of their future. As they looked around them, they observed that Britain had secured control, in one form or another, of the most desirable parts of Africa, held large possessions in Asia, and ruled the ocean lanes from innumerable islands in the seven seas which provided naval bases and coaling stations. In comparison, the German colonies in Africa and Asia and the German islands in the Pacific were pitifully inadequate. They were not generally suitable for white colonization, the small German population consisting of officials, soldiers, and traders; their trade with the mother country was infinitesimal; and they were a financial

burden to the home government. Even the early colonial nations that were no longer major powers—Spain, Portugal, and the Netherlands—were better off than Germany. The prevailing view was that colonial possessions were necessary for an industrial nation in order to supply the raw materials needed in industry, to furnish markets for manufactured goods and opportunities for the investment of capital, to provide outlets for emigration, and to offer careers for ambitious persons. Germany, not having rich, productive, and populous colonies, felt discriminated against, even though it could and did buy and sell freely throughout the world.

So, in the last decade of the 19th century, there arose in Germany a tremendous agitation and a loud cry for "a place in the sun"; along with this, the charge was frequently made that out of jealousy and hatred Germany's rivals, principally Britain and France, were standing in the way of the nation's acquiring its just due. The achievements of Germany in industrial progress, social legislation, and municipal administration were so universally admired by foreign visitors and observers that the Germans came to believe that they were a superior people, and they proclaimed this belief in innumerable books, pamphlets, and speeches. While other nations have always held high opinions of themselves, they have never carried self-adulation to the pitch reached in Germany before 1914.

The *Alldeutscher Verband* (Pan-German League; see PAN-GERMANISM), a small but noisy and influential association of prominent persons, proclaimed that it was necessary to complete the unification of the Germanic peoples of Europe, millions of whom did not live within the empire established in 1871, and writings of all kinds set forth in detail what was wanted elsewhere in the world. Since these programs were to be realized at the expense of other nations, it was often stated that Germany would use force if necessary to achieve its ends. A vast literature in praise of war as a necessity for Germany and as a purifying experience came into existence, and the German Army became the most venerated institution in the country. Emperor William II helped by his flamboyant speeches to create the impression that Germany was bent on war and would stop at nothing. Foreign visitors were uniformly impressed and alarmed by German militarism, which before 1914 was regarded outside of Germany with something like the horror felt in the 1950's and 1960's toward communism outside the Soviet world.

The German government never associated itself with the demands of the agitation for colonial expansion, but it resorted to methods of diplomacy which gave great offense. It utilized the South African (Boer) War of 1899–1902 to force concessions from Britain in Samoa; it seized the opportunity offered by the Russo-Japanese War of 1904–1905 to secure from Russia a commercial treaty that was unduly favorable to Germany; and when Russia, the ally of France, was defeated in the Far East, Germany forced France to get rid of its foreign minister and to change its policy with respect to Morocco. The British, Russian, and French governments regarded the German actions as blackmail and became increasingly suspicious of the ultimate aims of German policy. Inevitably they drew together in a diplomatic combination which



## † Emperor Franz Ferdinand.

Der Kaiserlicher und Kaiserliche Hof.

came to be known as the Triple Entente (q.v.), and the Germans denounced this action as "encirclement."

In addition, in 1900 Germany embarked on the construction of a navy intended to be second only to that of Great Britain. This was a favorite project of William II, and he declined all suggestions from Britain for a limitation of naval armaments. The greater the German Fleet grew, the more dangerous it seemed to the British, who regarded their century-old naval supremacy as the foundation of their political independence and the condition of national existence. For military as well as for political reasons, therefore, Britain drew closer to France and Russia, and the closer these relations became the more Germany complained of encirclement. The problem presented by Germany to the other European powers must be kept in mind in considering what happened in July 1914.

Nevertheless, despite what has been said about German ambitions, the primary cause of World War I was the conflict between the political frontiers of the European nations and the distribution of the various peoples of Europe—the denial of what is commonly called the right of self-determination, although this term was not generally used before 1914. From the Rhine eastward the political frontiers of Europe, as fixed by the Congress of Vienna in 1815 or determined by the wars of the 19th century, cut across recognizable lines of nationality. In the west, Germany held Alsace-Lorraine (q.v.), taken from France in 1871 against the wishes of its people, who disliked German rule and wished to return to France; it is not too much to say that the blunder of Germany in annexing Alsace-Lorraine and the refusal of France to recognize its loss constituted the most important single factor in the history of Europe from 1871 to 1914. East of Germany lay Austria-Hungary, which contained 11 different ethnic groups, 9 of which were kept in greater or less subjection by a ruling clique of Germans and Magyars;



many of the Germans dreamed of union with the German Empire. In the Balkans ethnic and political boundaries, the latter determined by the Treaty of Berlin (1878) and the Treaty of Bucharest (1913), rarely coincided. The Russian Empire in 1914 possessed vast non-Russian territories, which were later represented by Finland, Estonia, Latvia, Lithuania, Poland, and the Rumanian province of Bessarabia. Poland was the most notorious case of the denial of self-determination, for it had been divided between Austria, Prussia, and Russia in the late 18th century and again in 1815. A minor case was presented by Schleswig-Holstein (q.v.), where a Danish minority lived under Prussian rule.

The Austro-Hungarian, German, and Russian

governments showed little skill in handling their minorities. Some groups were treated more harshly than others, but everywhere the minorities grew increasingly restless under political repression and economic oppression, and they demanded concessions. In Austria-Hungary some minorities were able to look across their frontiers to the free kinsmen who, they hoped, would one day free them from the antiquated rule under which they suffered. The Yugoslavs of both Austria and Hungary, refused concessions by their Habsburg rulers, looked for help to Serbia, which, under King Peter I Karageorgevich, was independent nation; and the Rumanians of southeastern Hungary, gazed

which had a Hohenzollern king. The Austrians refused to give up hope of reunion, which, they were well aware, could come about only as the result of a war involving their three partitioners, and many Poles undoubtedly welcomed the coming of war in 1914.

This conflict between existing governments and their unhappy minorities was the factor primarily responsible for the catastrophe of 1914. Germany understood that the annexation of Alsace-Lorraine could be maintained only by the sword and armed accordingly; France was equally aware that the lost provinces could be regained only by the sword, and for years many Frenchmen dreamed of a war of revenge. This Franco-German irreconcilability poisoned the international atmosphere. The multinational Habsburg monarchy came to rely more and more on force and less and less on the loyalty of its peoples, which was slowly but surely seeping away. The partition of Poland was maintained only by the armies of the three partitioning powers; and the frontiers of the Balkan states depended exclusively on armed might.

The victories won by Prussia in its wars against Denmark, Austria, and France in 1864-1871 were generally attributed to the superiority of its conscript armies over the semiprofessional troops of the vanquished. It was not surprising, therefore, not only that the new German Empire continued to recruit its armies by universal military service, but also that the Continental neighbors of Germany adopted the same system. Only Great Britain retained the volunteer system for raising its relatively small army, which was designed to defend the British Empire and not to join in a Continental war. As population increased, so did the numerical strength of the European armies; in addition, every improvement in the weapons of war by one country was a challenge to all. From 1872, when France adopted the German system, until 1914, every government spent as much money on armaments as it could persuade its people to pay for in taxes or as the national economy could afford; the cost was easily borne by an increasingly prosperous Germany but was ruinous for Italy. This competition did not, however, produce any increased feeling of security. On the contrary, the proportionate strength of the various armies was not very different in 1914 from what it had been 40 years earlier; the feeling of insecurity was much greater, as may be seen in the war memoirs of Gen. Erich F. W. Ludendorff.

Disputed and unstable frontiers were not, of course, the only reason for great armies. European governments had always maintained armies, partly to keep order at home, partly as levers in

diplomatic bargaining, and sometimes for aggression and conquest; but the determination of monarchs and governments to preserve their territories intact in the face of increasing dissatisfaction with existing frontiers and conservative institutions made the competition in armaments more costly and more dangerous than it had been in previous generations.

**Development of Rival Alliances.**—It was the growing feeling of insecurity that led the European governments, one after another, to try to strengthen their positions by concluding alliances with other governments having similar interests. To Germany belongs the doubtful honor of inaugurating this system of alliances as well as the system of conscript armies, for it was Prince Otto von Bismarck, the principal author of the wars of 1864-1871 and German chancellor after 1871, who in 1879 made an alliance with Austria-Hungary and in 1882 brought about the Triple Alliance (q.v.) of Germany, Austria-Hungary, and Italy. These alliances were something new in the history of Europe, since in the past alliances had usually been concluded for specific purposes and were dissolved when the aim was accomplished; the alliance of France and Sardinia in 1859 to drive Austria out of Italy is an example. The alliances arranged by Bismarck were intended to be permanent; the Triple Alliance survived until 1915, and the Austro-German treaty until it was dissolved by military defeat in October 1918. According to the tradition of the balance of power (q.v.), which is centuries old in European history, the creation of a counterpoise to this grouping was to be expected. Bismarck was able to stave off such a counterpoise by clever diplomacy, first by the renewal of the Three Emperors' League (Germany, Austria-Hungary, and Russia) from 1881 to 1887, and then by the Reinsurance Treaty with Russia from 1887 to 1890, which kept France isolated. After his dismissal in 1890, however, his successor, Gen. Count Leo von Caprivi, rejected his system as too complicated, and in 1891-1894 a Franco-Russian alliance, which had been Bismarck's nightmare, came into being. One combination of powers dominated the center of Europe, while the other possessed the periphery.

Both of the Continental alliances were originally strictly defensive, providing for the maintenance of the status quo and for assistance only if one of the parties were attacked. Gradually, however, each alliance was altered. The Triple Alliance was modified to permit changes in the status quo in the Balkans, in Africa, and even in Europe; in the second treaty of the alliance, concluded in 1887, Germany promised under certain conditions to support Italian claims to Nice and Savoy (which had been ceded to France in 1860 as payment for French help in the war for Italian unification). In 1899 the Franco-Russian alliance was modified to provide for "the maintenance of the balance of power," the words being designed to take care of the situation which might arise when Austria-Hungary went to pieces, as it was confidently expected to do when Emperor Francis Joseph I should die. Finally, in 1909, the Austro-German alliance was given a new meaning when the chief of the German General Staff, Col. Gen. Helmuth von Moltke, in an exchange of letters with the Austrian chief of staff, Gen. Baron (later Field Marshal Count) Franz Conrad von Hötzner-

dorf, promised that if Austria invaded Serbia and Russia intervened on behalf of the latter, Germany would go to the help of Austria-Hungary. (In spite of many solicitations, Bismarck had consistently refused to make this promise, for he always insisted that Austria must not provoke Russia.) Thus the alliances ceased to be the guarantors of the status quo and might become instruments of aggression. Except in the case of the Austro-German treaty of 1879, the text of which was published in 1888, the terms of the Triple Alliance and the Franco-Russian alliance were closely guarded secrets which, so far as is known, were not penetrated by espionage or revealed by treachery. Although there was much speculation about the possible terms, the guesses were wide of the mark; the texts of the several treaties were not revealed until after the war, and in the absence of positive information the imagination had free rein.

Great Britain did not at first join either of the Continental groups, preferring a policy of "splendid isolation" or a "free hand." Although, according to the treaties of alliance, the two groups were directed against each other, in the 1890's they were more often concerned with diplomatic action against Britain; they stood, as it were, not face to face but side by side. In 1898 and again in 1901, Britain tried to reach an agreement with Germany, but the German terms were too high: Britain was asked to join the Triple Alliance, which it was unwilling to do because it was reluctant to underwrite what was later called the "ramshackle" Habsburg state. The German chancellor of the day, Count (later Prince) Bernhard von Bülow, was confident that in the end Britain must come to heel and stood on his terms. But in 1904, in the so-called Entente Cordiale (q.v.), Britain adjusted its many disputes with France in various parts of the world, and in 1907 it compromised its differences with Russia in the Middle East. Germany therefore found itself confronted by the Triple Entente of the three nations which it had believed impossible of realization. Europe was not mentioned in any of the agreements made by Britain with France and Russia, but by settling their own differences, they secured for themselves free hands in dealing with Germany.

The dominant position which Germany had hitherto occupied in Europe was further undermined by the action of Italy. In 1902, Italy had concluded a secret agreement with France by which it promised to remain neutral if the latter went to war with Germany in consequence of a German attack on Russia. Then, in 1909, Italy had reached a secret understanding with Russia by which both parties recognized each other's interests in the Balkans and promised support for each other's policies. Thus for some years the Triple Alliance was a broken reed, and in opposing the Triple Entente Germany was thrown back on Austria-Hungary as its one reliable ally and supported that ally in its dangerous Balkan policy.

Germany was slow to recognize that it had brought this situation on itself by its own mistakes. When the Entente Cordiale of 1904 permitted France to go ahead with its plans for obtaining control of Morocco, the German government raised strong objections to the French actions and by a covert threat of war (about which Bülow boasted in his memoirs) not only compelled the French foreign minister, Théophile

Delcassé, to resign (June 1905), but also forced France to submit the question of Morocco to an international conference, which was held at Algeiras in January-April 1906. This proved to be a Pyrrhic victory, for not only did the conference on the whole support the pretensions of France, but the British government, which had been greatly worried by Germany's conduct, authorized the beginning of secret military conversations between the British and French general staffs. These conversations, which were not revealed until 1914, led to the formulation of plans for sending a British army of 160,000 men to fight alongside the French Army in case Britain decided to join France in war.

In 1911, Germany again challenged France over Morocco, which seemed to be passing under French control, and this time the German government sent a gunboat to the closed port of Agadir. The French were willing to negotiate, being prepared to buy off German opposition in Morocco by making concessions elsewhere in Africa. The German move made the British so uneasy, however, that a pacifist cabinet minister, David Lloyd George, delivered at the Mansion House in London a sensational speech to the effect that Britain was not to be ignored, a speech that angered the Germans but forced them to recognize that they could not ride roughshod over France. In the end a Franco-German compromise was reached whereby Germany gave up its aspirations in Morocco (which had never been clearly formulated) in return for two strips of French Equatorial Africa.

Nevertheless, the consequences of the Agadir crisis were far reaching. The German government promptly decided to increase its navy and refused to discuss a possible limitation of naval armaments unless Britain would promise to remain neutral in a European war. Not only did Britain decline to give any such promise, but in the summer of 1912 it entered into an agreement with France by which the entire French Fleet was to be deployed in the Mediterranean while the British Navy guarded the North Sea and the English Channel. Moreover, in November 1912, secret notes were exchanged between the British and French governments to the effect that if Britain should decide to participate in a European war, the plans drawn up by the general staffs would form the basis of action. The notes still left Britain free to decide whether to take part in a war, and it did not decide to do so until August 1914, but its decision was certainly made easier because of the secret military conversations. Thus German diplomacy was responsible for the expansion of the original Anglo-French entente into a close-knit diplomatic combination which did not exclude the possibility of resort to war.

Germany also acted unwisely toward Russia. In October 1908, when Austria-Hungary proclaimed the annexation of the Province of Bosnia and Hercegovina, Germany gave unqualified support to the action of its ally, and March 1909 forced the Russian government to accept the annexation by a threat to let matters take their course—that is, to let Austria attack Serbia. The Russian government did not forget or forgive this brutal German step, and in the next few years not only tightened its ties with France, but sought closer relations with Britain.

Actually, Anglo-Russian relations never achieved the intimacy prevailing between Britain

and France. Russian interests in the Balkans and the Middle East were never regarded in England as something Britain might have to fight for (as it was prepared to fight for French interests in Morocco), and Russian activity in Persia was much disliked and sharply criticized. When, in the spring of 1914, the Russian foreign minister, Sergei Sazonov, proposed that the Triple Entente be converted into a triple alliance, this invitation was declined by the British foreign secretary, Sir Edward Grey. Grey agreed, however, to the Russians' being informed of the Anglo-French notes exchanged in 1912 (which were then betrayed to the German government by a spy in the Russian embassy in London). He also agreed to the opening of conversations between the British and Russian admiralties; these conversations had barely started when the crisis of July 1914 broke out, but the Germans got wind of them and were much upset. Grey denied to the German ambassador in London that Britain was allied with France and Russia, but he admitted that it "did from time to time talk with them as intimately as allies." Thus in 1914 the Triple Entente had become a very tight diplomatic group.

In the autumn of 1912, when the small Balkan states pounced on Turkey and almost drove it from Europe, Germany manifested a change of front. While in general terms it stood by its Austrian ally, it did not push that ally to extreme action, it tried to bring about a compromise between Austria and Russia, and above all it worked in close association with Britain. The happy result was that, although the Balkan states quarreled among themselves and fought one another in 1913, the general peace of Europe was not broken. This Anglo-German cooperation was so striking and so successful that a similar course seemed indicated to solve the crisis of 1914.

In the course of the long Balkan crisis, Italy found it to its interest to work with Austria-Hungary for the establishment of an independent Albania, and in the winter of 1913-1914 new military and naval conventions with Germany and Austria seemed to bring the wavering ally back into the fold of the Triple Alliance. General von Moltke became convinced that Italy's loyalty was "not open to doubt," and he acted on that assumption, although the German Foreign Office did not, in the crisis of 1914.

**Crisis of 1914.**—At long last, in July 1914, the Triple Alliance and the Triple Entente stood face to face. Was war the inevitable consequence of this schism of Europe into two groups of great powers, three on each side? Certainly there was no immediate prospect of such a calamity, at least as far as western Europe was concerned. Relations between Britain and Germany were much better than they had been for some years, thanks largely to an informal agreement for the construction of battleships in the ratio of 16 to 10 and to the cooperation between the two governments during the Balkan crisis. By the spring of 1914 they had negotiated and were ready to sign the two agreements concerning the future of the Portuguese colonies and the completion of the Baghdad Railway. The British government assumed that, in the event of a new Balkan crisis, it could count on German help to deal with it; the German government had come to the conclusion that, in the event of war, Britain would not necessarily take the side of France, although the German ambassador in London re-

peatedly warned to the contrary.

After the great crises of 1905 and 1911, over Morocco, Franco-German relations had also taken a turn for the better. In February 1914, an agreement analogous to the Anglo-German bargain was reached concerning railway projects and spheres of economic interest in the Ottoman Empire; subsequently the president of the republic, Raymond Poincaré, who was later denounced in some quarters as a warmonger, broke the tradition of 40 years and dined at the German embassy. To be sure, Alsace-Lorraine had not been forgotten, but the German ambassador recognized that there was practically no sentiment for a war of revenge, and the elections of April-May 1914 gave a majority to the parties of the left, which were pledged to reverse the increase in military service from two to three years that had been effected in 1913; World War I broke out, however, before such action could be taken.

In midsummer 1914, then, both Anglo-German and Franco-German relations were more friendly than they had been for many years and contained no threat to peace. On the other hand, the Balkans and the Middle East were full of trouble. At the end of 1913 much tension had been produced between Russia and Germany by the dispatch of a German military mission under Gen. Otto Liman von Sanders to Constantinople for the purpose of rehabilitating the Turkish Army after the defeats of the Balkan Wars. For more than a century successive Russian governments had been fascinated by the problem of the Bosphorus and the Dardanelles, the straits which controlled the exit from the Black Sea to the Aegean. Several times Russia had succeeded in effecting an alliance with Turkey in order to send its warships through the straits, but in each instance it had been forced by circumstances to abandon the alliance, and in 1841 an international convention had closed the straits to the men-of-war of all nations except Turkey. On various occasions the Russian government considered the seizure of Constantinople by military force, but it never actually attempted to do so. At the end of 1913 it decided that Russian interests would be served by the continued existence of a relatively weak Ottoman Empire. Since the Liman von Sanders mission had for its object the strengthening of that empire, Sazonov was greatly disturbed and, although this was not known until after the war, revived the idea of seizing Constantinople, only to have it rejected both by his colleagues in the government and by the General Staff. Happily, a compromise was reached about the German mission, but public opinion in both countries remained excited.

In Albania its creators, Austria-Hungary and Italy, were busy trying to thwart each other and making life difficult for the newly appointed king, the German prince William of Wied. Bulgaria was sullenly nursing its defeat at the hands of Greece, Rumania, and Serbia in 1913, and was courting the favor of Austria. Greece and Turkey were at loggerheads over certain islands of the Aegean. But the spark that set off the explosion in the Balkans was a completely unexpected incident, the assassination of Archduke Francis Ferdinand and his wife on Sunday, June 28, 1914.

That tragedy was the culmination of an antagonism between Austria-Hungary and Serbia that had been growing for a generation. In 1859, Austria had faced the question of Italian unifor-



tion, and had been driven out of Italy; in 1866 it had faced the same problem in Germany, with disastrous results. Beginning in 1903, when there was a change of dynasty in Serbia, it was confronted by the Yugoslav problem, which was certainly not easy to solve. Historically, the Yugoslavs had never been united. They consisted of three branches: the Slovenes, Roman Catholics using the Latin alphabet, who lived under Austrian rule in Carinthia and Carniola and were often at odds with the Germans; the Croats, also Roman Catholics using the Latin alphabet, living mostly in Croatia, a province of Hungary, but also in Dalmatia, an Austrian province, in which the Italian element was favored by the Austrian authorities; and the Serbs, members of the Orthodox Eastern Church using the Cyrillic alphabet, living chiefly in independent Serbia and Montenegro, but also in Bosnia and Herzegovina under joint Austro-Hungarian rule, where many of them were Muslims, and in Old Serbia, which was still a part of Turkey. Serbo-Croat was one language, written in both alphabets; Slovene was a kindred language. By 1914 it was evident that a national movement in favor of uniting the various branches of Yugoslavs was getting under way within the Habsburg state because of their discontent with the shabby treatment they had received from the Austrian and Hungarian governments. At the same time, those Serbs who were independent began to dream of drawing their kinsmen under Habsburg rule into their own state. Naturally, the ruling groups in Austria-Hungary hoped to prevent this, and they aspired to bring Serbia into the monarchy.

In 1881, Milan IV Obrenovich (Obrenović), then prince of Serbia, had concluded a secret treaty with Austria-Hungary which placed his little country under the control of Vienna and paved the way for economic subjection. This situation lasted until 1903, when Milan's son and successor, King Alexander I, was murdered by a group of army officers who resented the humiliation of their country. Since Alexander had no heir, the throne passed to Peter Karageorgevich (Karadjordjević), whose ancestor had organized the revolt of Serbia against Turkish rule in 1804. Abandoning the autocratic methods of Alexander, Peter became a constitutional monarch and allowed the Radical Party, under Nikola Pašić, to govern. The Radicals managed to free Serbia from the economic domination of Austria-Hungary and to acquire the goodwill of Russia, traditionally the opponent of Austria in Balkan affairs. The spectacle of little Serbia defying mighty Austria made a strong appeal to the Yugoslavs within the Dual Monarchy, who were unable to obtain concessions from Vienna and Budapest.

This new situation forced the ruling elements of the monarchy to consider the problem afresh. The military party, led by Conrad von Hötzendorf, urged war against Serbia, which would have led to direct annexation of the defiant little neighbor. The political leadership was more cautious, knowing that war might provoke Russian intervention, and contemplated a customs union or a change of dynasty, which might be accomplished by diplomacy, but it was just as eager as the soldiers to extinguish Serbian independence and thus beat down the restlessness of its own Yugoslav population. As a first step in this direction, Austria-Hungary in October 1908 proclaimed the annexation of Bosnia and Herzegovina, lands with a mixed population of

Serbs and Croats which had been under Habsburg occupation and administration since 1878 but were nominally still parts of the Ottoman Empire (where the revolution of July 24, 1908, had overturned the absolute rule of Sultan Abdul Hamid II). This action precipitated a five months' crisis involving Austria's relations with Turkey, the great powers, and Serbia; it almost resulted in an Austrian attack on Serbia and came to an end only after Germany had sent its near-ultimatum to Russia, requiring it to recognize the annexation without reference to a European conference. The Russian foreign minister, Alexander Izvolski, accused the Austrian foreign minister, Baron (later Count) Alois Lexa von Aehrenthal, of having tricked him, and he bitterly resented the intervention of Germany.

The echoes of this conflict had not died away in 1914. Although Austria compelled Serbia to recognize the annexation, it was another Pyrrhic victory, for the Serbs retaliated by forming two societies: one, *Narodna Odbrana* (National Defense), was public; the other, *Ujedinjenje ili Smrt* (Union or Death), popularly known as *Crna Ruka* (Black Hand), was secret and had been formed for propaganda and agitation in Bosnia against Habsburg rule. A revolutionary movement known as *Mlada Bosna* (Young Bosnia) also sprang into existence and inspired more than one attempt to assassinate Austro-Hungarian officials in Bosnia and Croatia. The ruling classes in the monarchy were deeply disturbed by this unrest, which they were unable to curb or to suppress.

In the plans of the Austro-Hungarian government for dealing with the Yugoslav problem, Archduke Francis Ferdinand played a peculiar role. He was convinced that the existing system of dualism, whereby Germans ruled in Austria and the Magyars in Hungary, although both were minorities, was driving the Habsburg state to destruction; in particular, he hated the Magyar ruling clique and hoped to break its power. He proposed to solve the Yugoslav problem by granting to the Yugoslavs within the monarchy, whether they lived in Austria, Hungary, or Bosnia, full autonomy and unity, which would mean the end of dual rule; he then hoped to bring Serbia into some kind of connection with the monarchy. No one can say whether the archduke would have been able to carry out his somewhat nebulous plans had he lived to succeed his uncle Francis Joseph in 1916. He was hotheaded, bigoted, avaricious, and disliked by large numbers of his future subjects, and any attempt to carry out his plans would have met with determined resistance by both Germans and Magyars. But his violent death at the hands of a man of Serbian stock, though a Habsburg subject, provided the forward party in the Austro-Hungarian government with an excuse for action against Serbia that was too tempting to neglect.

Many details of the crime at Sarajevo have never been revealed. That the assassins—Gavrilo Princip, who did the actual killing, and two others—came from Bosnia and hated Francis Ferdinand as the symbol of Habsburg oppression, were supplied with arms in Belgrade, and secretly passed across the frontier into Bosnia, became known in 1914 and was used by the Austro-Hungarian government as justification for its demands on Serbia. The person most often credited with inspiring the crime was the chief

of the intelligence section of the Serbian General Staff, Col. Dragutin Dimitrijević, but the evidence is not conclusive. How much the Serbian government knew about the plot in advance, and what steps, if any, it took to prevent the execution of the crime either by warning the Austrian government or by attempting to stop the assassins from crossing into Bosnia—these are questions to which no sure answer is possible; the present government of Yugoslavia, successor to the Serbian government of 1914, has not opened its archives, and there are many conflicts in the unofficial evidence that is available. Equally uncertain is the reason why the authorities in Sarajevo did not take proper precautions to protect the heir to the throne. Actually, the answers do not matter, for an official sent from Vienna to Sarajevo reported that the responsibility of the Serbian government was not established; nevertheless, the action of Austria-Hungary could hardly have been more drastic if the official complicity of Serbia had been proved.

The situation in 1914 cannot be judged, however, exclusively in terms of Austro-Serbian relations. Serbia, though a small nation with a population of less than 5,000,000, enjoyed the friendship of Russia and occupied a key position in Europe. Rumania was the ally of Austria-Hungary; Bulgaria was anxious to be admitted to the Triple Alliance; in Turkey, German political and military influence was stronger than that of any other power. If Serbia could be brought under Austrian control, then German-Austrian influence would prevail from Berlin to Baghdad. If, on the contrary, Serbia could be maintained as an independent state, a wedge would be driven into the German-Austrian-Bulgarian-Turkish combination, and Constantinople would be susceptible to Russian, French, and British pressure. So the crisis of July 1914 was concerned with far more than the question whether, as Austria-Hungary demanded, Austrian officials should go into Serbia and investigate the details of the crime at Sarajevo. The issue was a test of strength between the Triple Alliance and the Triple Entente; at stake was the balance of power in Europe for an incalculable time to come.

See also historical sections of articles on the various European powers; biographies of the leading figures; **BALKAN WARS**; **CONSCRIPTION**; **EASTERN QUESTION**; **FAR EASTERN AFFAIRS**; **MIDDLE EAST—5. History**; **NATIONALISM AND INTERNATIONALISM**; **TWENTIETH CENTURY—Warfare**; **WORLD ECONOMIC, POLITICAL, AND SOCIAL DEVELOPMENTS IN THE 20TH CENTURY**.

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### 3. War Declared

Although all the European governments were responsible in greater or less degree for the development of the system of alliances and for the huge accumulation of armaments, and to that extent contributed to the tension that came to a head in July 1914, they were not equally responsible for the fatal outcome of the crisis. Immediately after the war began, the governments began to issue collections of diplomatic documents; these came to be known by the colors of the covers in which they were bound: the German collection as a White Book, the Austrian as a Red Book, and the Russian, French, British,

Belgian, and Serbian as Orange, Yellow, Blue, Gray, and Blue Books, respectively. Each government set forth its case in these books and laid the blame for the war on the enemy; it sought not only to convince its own people of the rightness of its conduct, but to obtain the goodwill of neutral countries, especially the United States.

All during the war hot debate raged over this question of war guilt. *The Evidence in the Case* (1914), a book by James Montgomery Beck, an eminent American lawyer, placed the blame for the war primarily on Germany and enjoyed a wide circulation. After the war, when secret archives began to be opened, much fuller collections of documents were published, and these were selected by historians rather than by politicians and propagandists. It was then seen that the documents issued in 1914 had been chosen to make out a case, and that they had often been tampered with. Sometimes texts had been changed, awkward documents had been omitted, and occasionally documents had been fabricated to order. From the fairly complete diplomatic files of the Austrian, British, French, German, and Russian governments now available, together with the memoirs of politicians, diplomats, military men, and journalists, it is possible to write a dispassionate and accurate account of European diplomacy from the murder of Archduke Francis Ferdinand and his wife at Sarajevo on June 28, 1914, to the outbreak of the general European war in August.

**The Austrian Ultimatum and the Role of Germany.**—The Austro-Hungarian government quickly decided that the heaven-sent opportunity for a reckoning with Serbia was not to be lost. Inasmuch as action against Serbia might lead to the intervention of Russia, however, the cabinet of Vienna wished to know what Germany was prepared to do in such a situation. Although the German General Staff had declared in 1909 that Russian intervention to help Serbia would cause Germany to mobilize (in German terminology, this step was the prelude to war), the German government had steadily restrained the war party in Vienna during the Balkan Wars of 1912–1913. Furthermore, the German emperor, William II, was suspected of being partial to Serbia. In order to ascertain the state of mind in Berlin, Emperor Francis Joseph I therefore wrote a letter to William, stating that Austria-Hungary must aim at the "isolation and diminution of Serbia," which must be "eliminated as a political factor in the Balkans." The Austro-Hungarian foreign minister, Count Leopold von Berchtold, drew up a long memorandum which urged that Bulgaria, Serbia's bitter enemy, be admitted into the Triple Alliance, and stated that it was "imperative" for the monarchy to take strong action against Serbia. What action was contemplated was explained orally by a special emissary sent from Vienna to Berlin, Count Alexander von Hoyos, who said that the plan was to "march into Serbia" without any warning and then to partition it between Austria-Hungary, Albania, and Bulgaria.

Only two weeks before, the German chancellor, Theobald von Bethmann-Hollweg, had said that, in the event of a new crisis arising in the Balkans, "whether . . . it would come to a general European conflagration would depend exclusively on the attitude of Germany and England." When Hoyos appeared in Berlin on July 5, however, this caution was forgotten.

The Austrian plan to invade and partition Serbia was cordially received by the German emperor and the German government, and immediate action was urged on the Austro-Hungarian government. Because a royal personage had been killed, William II believed (so he asserted) that Czar Nicholas II would not go to the help of Serbia, but if he did so, Germany was ready to support Austria and wage war against Russia and France. This decision by William revealed at its worst the personal rule of the emperor, who did not consult his chancellor or his military advisers; he "told" them what he had done and left them to face the consequences, and they lacked the power, or the will, to reverse his decision. It is worth noting that the German embassy in Russia was not asked whether the emperor's interpretation of the czar's state of mind was correct. Seldom if ever was a decision of the highest importance reached with more haste and recklessness. William and Bethmann-Hollweg accepted the risk of war with unbelievable nonchalance; it was they who put the system of European alliances to the test.

The decision was not a matter of Germany's putting its head into a noose (as was sometimes asserted) and then being strangled; both emperor and chancellor had been informed of the Austro-Hungarian plans and knew what they were supporting. Their assumption that Britain would remain neutral in a European war was contrary to what their ambassador in London had been saying for 18 months. The German General Staff was confident that Germany and Austria-Hungary could defeat Russia and France; it assumed that war was inevitable and welcomed the prospect, for victory would be easier in 1914 than in 1917, when French and Russian military reorganization would be completed. It was not alarmed by the possibility of British intervention, for it expected that such intervention would be delayed, or that, if it came immediately, the small British Army would be overwhelmed by the German legions advancing through Belgium and France. Some conservative circles in Germany (Bethmann-Hollweg mentions this) regarded war as a good method of dealing with the menace of socialism, which seemed to be steadily increasing. The idea of consulting the elected representatives of the German people in the Reichstag apparently occurred to no one.

The foreign policy of Germany had long vacillated between east and west. From 1890 to 1914 (that is, from the dismissal of Prince Otto von Bismarck as chancellor to the outbreak of war), the German government pursued a policy of expansion in both directions. Admiral Alfred von Tirpitz and the Navy League considered Britain the enemy and advanced the building of the fleet, although the more they built the more they drove Britain into the arms of France and Russia. To the General Staff, France was the eternal enemy, and the army therefore was steadily expanded. Businessmen were divided, some looking to Africa and the colonial empires of Britain and France, while others preferred the Middle East, where the Baghdad Railway was the symbol and instrument of German expansion. The emperor and his chancellors never made up their minds where the fundamental interest of Germany lay; they acted as if they thought that Germany was strong enough to move both east and west. In 1914 they were seriously concerned about the future

of Austria-Hungary, their one reliable ally, and they persuaded themselves that only a military expedition against Serbia could stop the decay of the Habsburg empire even though the German ambassador in Vienna was highly skeptical about its possibility of survival. The reason officially offered by the German government for its action was the necessity of aiding its hard-pressed ally. The decision to act thus, in the calculation that Britain would remain neutral, may be interpreted as meaning that the long vacillation had been ended at least temporarily by a decision to go east.

The Austro-Hungarian government was now free to act, but the opposition of Count István Tisza, the Hungarian premier, forced Berchtold to abandon his plan to march into Serbia, and a Council of Ministers held on July 7 decided on a 48-hour ultimatum, which theoretically would offer Serbia a chance to submit. Actually, seven supposedly unacceptable demands were incorporated in the note so as to ensure the rejection of the ultimatum and open the way to military action. As the minutes of the meeting reveal, the treatment intended for Serbia included "rectifications of frontier" for the benefit of Austria-Hungary, while other parts of its territory were to be allotted to Bulgaria and Albania; what was left of Serbia was to be attached to the monarchy by a military convention to be signed by a new dynasty. These designs were naturally not mentioned when the Austro-Hungarian government later declared to the other powers that it did not intend to take Serbian territory for itself.

The ultimatum, probably the most formidable document which had yet been addressed by one independent state to another, was presented to the Serbian government on July 23. It contained 10 demands, the most important of which required Serbia to admit Austrian officials in order to suppress agitation against the Dual Monarchy and to take action against the persons involved in the murder at Sarajevo. Outside of Austria-Hungary and Germany the note was regarded as a monstrous document which no independent state could accept. To the complete surprise and intense annoyance of Vienna, the Serbian reply, delivered on July 25 a few minutes before the expiry of the ultimatum, was conciliatory and to a large extent appeared to accept the Austrian demands, as was later stated by both the German emperor and the German chancellor. Nevertheless, the Austrian minister, after a cursory reading of the document, broke off diplomatic relations and left Belgrade; later in the day, partial mobilization of the Austrian Army was ordered. Three days later, on July 28, 1914, Austria-Hungary declared war against Serbia—the fateful decision from which all subsequent troubles derived. The military chiefs wished to wait until mobilization had been completed, but strong German pressure forced immediate action, which began with the bombardment of Belgrade on July 29.

**Russian and German Intervention.**—The Austrian action precipitated the intervention of Russia. Although for generations the principal Russian interest in the Balkans and the Middle East had been the question of the Bosphorus and the Dardanelles, that question was dormant in July 1914. The Russian move was determined by the other facet of its policy in the area: the tradition of defending the Slavic peoples of the



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Above: Order to mobilize German Army for war on Russia is read to a crowd in Berlin on Aug. 1, 1914. Right: Declarations of war from July 28 to Aug. 4, 1914, are headlined in the newspapers of Great Britain, the United States, Germany, and France.



Balkan Peninsula against Turkish misrule or German (Austrian) pressure. Since the annexation of Bosnia and Herzegovina in 1908, Serbia had looked to Russia for help against Austria-Hungary, but Russia had not fully recovered from its defeat by Japan and the abortive revolution of 1905, and Foreign Minister Alexander Izvolski and his successor, Sergei Sazonov, put off the importunate Serbs with promises for the future. The Russian government probably did not want war in 1914, for its army was undergoing reorganization, and revolutionary symptoms (notably in the form of strikes) were again in evidence. Nevertheless, it had to help Serbia or see that country crushed by Austria.

Such an eventuality was contrary to the interest of Russia and was strongly opposed by Russian public opinion. Sazonov believed (correctly, as we now know) that the Austrian assurances of disinterestedness were equivocal and insincere. He tried to have the terms of the Austrian ultimatum modified, but to no avail; when he learned of the bombardment of Belgrade, he ordered the partial mobilization of the Russian Army on July 29. This decision, like the German decision of July 5 and the Austrian decision of July 25, was taken without proper reflection, but its purpose was to make clear that Russia would act if Austria attacked Serbia in earnest (the Austrians did not plan to attack until August 12, but this was not known in St. Petersburg). Sazonov's calculations doubly

misfired. First, the news of partial mobilization did not deter Vienna (and Berlin) from the course chosen. In the second place, the Russian General Staff, which had not been consulted, had no plan for partial mobilization and convinced the foreign minister that it was impracticable, and that general mobilization must be ordered. Nicholas II, with whom the final decision rested, wavered, giving his consent on the evening of July 29 and then withdrawing it. On July 30, he agreed, however, and the order was published on July 31.

The Russian general mobilization was ordered in the knowledge that it would be followed by German mobilization, as the German government had stated; in the German view, this meant war. Neither Austria nor Russia regarded mobilization as necessarily meaning war. Germany took that position because it planned to attack France first, defeat it in six weeks, and then turn on Russia; therefore, so the German argument ran, Germany could not afford to let Russia mobilize but must strike at once. In a sense, then, Russia "willed the war" when it ordered mobilization, and the Italian historian Luigi Albertini thought that the mobilization was premature, for by July 30 the British government had come forward with a plan that might have led to compromise and peace. Inasmuch as Germany had forbidden even a partial Russian mobilization, however, Russia had to mobilize or abdicate as a great power. The czar promised that his armies would not attack so long as ne-

negotiations continued, but these assurances seemed as dubious to Germany as the Austrian assurances about the integrity of Serbia seemed to Russia.

At the beginning of the crisis, Germany urged that the Austro-Serbian conflict be "localized," lest the operation of the system of alliances turn it into a general war, and refused to restrain its ally, which, in fact, it urged to act quickly. From the start the plea of localization was rejected by Russia, France, and Britain because they could not afford, as they saw their interests, to let Serbia be crushed. The German government also rejected a British proposal for a conference in London to try to find a solution for the Austro-Serbian conflict.

On July 28, the day on which Austria declared war on Serbia, the German emperor changed his mind. He decided that the conciliatory Serbian reply had removed "every reason for war," and he proposed that Austria stop with the occupation of Belgrade and offer to negotiate. On the following day, the British government came forward with an almost identical proposal. By this time it began to seem likely that, contrary to the original German calculations, Britain would be drawn into the war. So the German government, on the evening of July 29, shifted its ground and advised Vienna to accept the British proposal. Before the Austrian government had replied, rumors of Russian mobilization began to reach Berlin, and the chief of the German General Staff, Col. Gen. Helmuth von Moltke, pressed for war (as is admitted by the two most objective German students of the crisis: Herman Lutz, in *Die europäische Politik in der Julikrise 1914*, 1930; and Alfred von Wegerer, in *Der Ausbruch des Weltkrieges 1914*, 2 vols., 1939). On the evening of July 30, he persuaded the chancellor to relax the pressure on Berchtold to accept the British proposal, and he himself telegraphed to the Austrian chief of staff, Gen. Baron (later Field Marshal Count) Franz Conrad von Hötzendorf, urging the rejection of the proposal and promising Germany's full support if war resulted. Vienna did as Moltke desired and ordered Austrian general mobilization on July 31, before news had been received of the Russian general mobilization.

According to Gen. Erich von Falkenhayn, the Prussian minister of war, Germany could have waited a few days before reacting to the Russian general mobilization. When official news of this step reached Berlin on the morning of July 31, however, Moltke, with the help of William II (who had experienced another change of mind), secured the consent of Bethmann-Hollweg, who had been resisting the generals, to the proclamation of a *Kriegsgefahrzustand* (state of danger of war). This was the necessary preliminary to formal mobilization, which was ordered on the following day, August 1. Whether, without the intervention of Moltke, Austria would have accepted the British proposal, and whether a compromise with Russia could have been reached, no one can say; but it is clear that Moltke's interference prevented any last-minute negotiations in the interest of peace.

**The Roles of France, Britain, and Italy.**—Although the German-General Staff planned to begin the war with an attack on France, Germany had no dispute with that country in 1914. In order to have an excuse for such an attack, the General Staff declared the Russian mobili-

zation a *casus belli*, and France was asked if it, as the ally of Russia, would remain neutral. If France replied in the negative, as was expected, Germany would have a justification for making an attack. But events did not follow that course.

Germany declared war on Russia on August 1, which allowed the Russian government to say that it had been attacked when it was ready and eager to negotiate. According to the Franco-Russian alliance, the German attack on Russia required France to attack Germany, but the French government, in reply to the German demand for neutrality, said on August 1 that it would consult its interests, an answer explained by the determination of the government not to appear as an aggressor. The French reply did not stop the German armies from invading France; and on August 3, Germany declared war on France, alleging untruthfully that French planes had bombarded Nürnberg. Thus France as well as Russia appeared to be the victim of brutal aggression, a circumstance of great value in consolidating sentiment at home and winning help abroad.

France's part in the crisis of 1914 was almost automatic. While it had no direct interest in Serbia, it was the ally of Russia, and if it did not stand by that country, the alliance would be broken and France would be left isolated, possibly to face a repetition of the German challenges of 1905 and 1911. At the moment when the Austrian ultimatum was presented in Belgrade, President Raymond Poincaré and Premier René Viviani were paying a state visit to Russia, and they gave the czar and his ministers the promise that France would support Russia in opposing Austria-Hungary and Germany, a promise that certainly strengthened the resolution of Sazonov. Later, after the two Frenchmen had returned to Paris, the French government urged its ally to do nothing that would provide Germany with an excuse for war, but it did not object to any action taken by Russia. This attitude was so firmly supported by all shades of French public opinion that the government did not feel it necessary to reveal the terms of the Russian alliance. Thus both Germany and France supported their allies on an issue not of direct concern to themselves—Serbia; and so an Austro-Serbian quarrel became transformed, in the interest of the balance of power and by the operation of the system of alliances, into a general European war.

The role of Great Britain, on the other hand, was anything but automatic. The crisis found the Liberal government facing the prospect both of a general strike in England and of a civil war in Ireland over the question of home rule, possibilities which may have contributed to convince the German government that Britain would remain neutral. Actually, as soon as the European situation became ominous, the idea of a general strike faded away and the Irish controversy was adjourned, both Irish parties supporting the government in its efforts for peace. Sir Edward Grey, the foreign secretary, made various proposals for delay, discussion (by a conference of ambassadors in London meeting with himself), and compromise; all were rejected by Austria-Hungary and Germany.

The British government was asked by Germany to accept the principle that the Austro-Serbian conflict should be localized, with Britain



proclaiming its neutrality, and by Russia and France to declare its solidarity with them as the only means of restraining Germany from war. Grey, along with the prime minister, Herbert Henry Asquith (later 1st earl of Oxford and Asquith), and some other members of the cabinet, notably Winston Churchill, then first lord of the admiralty, believed that Russia could not be expected to stand aside and abandon Serbia. In the interest of future relations between Britain and Russia, Grey accordingly refused to exert pressure on the latter to do so or to advise against Russian mobilization. These cabinet members also believed that an Austro-German victory in the coming struggle would establish an ascendancy of Germany in Europe that would be dangerous for Britain. On the other hand, they could not announce British solidarity with Russia and France because at the beginning of the crisis a majority of the cabinet opposed British participation in the war, and this view was shared by most of their supporters in Parliament and by the country at large. At the time, even the military conversations of 1906 and the notes exchanged with France in 1912 were still secret.

Grey therefore had to conduct his policy, not according to his convictions of what the interests of Britain required, but in the light of what public opinion would support. He privately told the German ambassador that, in the event of war, Britain would be drawn in, and it was this statement which led the German government to modify its stand, but he apparently did not inform the cabinet of what he had done. It was not until Germany had declared war on Russia and had sent an ultimatum to France that, on August 2, Britain promised the latter that it would help defend the northern French coast against German attack. Even this promise was made dependent on the approval of Parliament and could be given only because the Conservative opposition agreed to support it. Since Germany had promised not to attack the French coast, the British promise would probably not have been put to the test if the former had not violated the neutrality of Belgium.

This reversed the situation immediately, for the German action convinced the cabinet, Parliament, and the country that it was necessary for Britain to enter the conflict, which it did with a declaration of war on Germany on August 4. Grey was later criticized for not making clear to Germany much earlier than he did that the violation of Belgian neutrality would be a *casus belli* for Britain. In all probability, however, this would have been to no avail. The German General Staff had only one plan for fighting the war, a plan which involved going through Belgium; Moltke, being confident that he could deal with a British army, desired rather than feared British intervention, and he could not have improvised a new plan on the spur of the moment. It was true, as Germans often asserted that for Grey the German action against Belgium was not the reason he wished Britain to participate in the war, which he urged on general grounds, but without the Belgian issue the British government probably could not have induced the British people to go to war in August 1914.

Ever since that time, the question has been debated whether a clear-cut declaration of British solidarity with France and Russia would have

prevented the war, but there is no agreement among the publicists, diplomats, and historians who have written on the subject. All that can safely be said is that Grey thought it impossible to make such a declaration and never proposed it to the cabinet. (Mindful of this controversy, the British government of 1939 did inform Germany that it would go to the help of Poland, but this did not stop Adolf Hitler from attacking that country.)

Italy, the sixth great European power, though the ally of Austria-Hungary, disapproved of the latter's actions from the start. If Italy's own struggle with Austria was any guide, Habsburg power probably could not suppress the Yugoslav national movement by force, but if it did succeed in doing so, Italian interests in the Adriatic would be affected. In addition, Italy did not wish to expose its long coastline to the British Fleet. The Italian government took advantage of the failure of Austria, contrary to Article 7 of the treaty of the Triple Alliance, to notify its ally in advance of its projected action and to settle the matter of compensation. On August 3, it declared that Austria and Germany were waging a war of aggression and proclaimed its neutrality; this action was of immense importance to France, which was enabled to withdraw its troops from the Italian frontier and send them against Germany.

**The Possibilities of Peace.**—Previous diplomatic crises involving Morocco or the Balkans had lasted weeks or even months, during which period diplomacy had time to function. In 1914 only 13 days elapsed between the Austrian ultimatum to Serbia and the beginning of general war. Austria-Hungary and Germany hoped to force the other powers to accept their violent action against Serbia. To meet this situation, which took them by surprise, Russia, France, and Britain resorted to improvisation, with not too happy results. Sazonov and Grey made new suggestions almost daily, before their previous proposals could have been considered, so that the diplomatic situation became increasingly obscure. The confusion reached its height on August 1, when Germany declared war on Russia at the moment when both that country and Austria were reported to be willing at last to negotiate. A little time was needed to determine what the situation actually was, but just as diplomats had previously made decisions without sufficient reflection, so now the military authorities, thinking in terms of mobilization timetables, began to take over from the civil authorities. The three emperors, Francis Joseph I, Nicholas II, and William II, all hesitated for a long time before they consented to the irrevocable measures of mobilization and declarations of war; unfortunately, the first was almost senile, the second weak, and the last volatile and impetuous. Furthermore, among the statesmen who had to make the decisions, there was no outstanding personality—no Camillo Benso di Cavour, no Otto von Bismarck, no Benjamin Disraeli—who could or did dominate the situation.

In the years from 1871 to 1914, peace was maintained in Europe by the combination of alliances and armaments. In the crises before 1914—in 1875, 1887, 1905, 1908–1909, 1911, and 1912–1913—governments did not go to war because they were not ready for war, were not sure of the support of their allies, or did not think the issues worth fighting for. In 1914

the balance of power was at stake for an indefinite time ahead, and the governments were more nearly ready for war than they had ever been. Austria-Hungary and Germany were determined on a military solution of the Serbian problem and wished to upset the status quo; Russia, France, and Britain were prepared to accept a diplomatic humiliation of Serbia but not its military subjugation, and while they were not committed to the status quo, they were not willing to let it be altered without their consent. Thus the system of alliances, which had originally served the cause of peace, operated almost mechanically in 1914 to convert a local conflict into a general war.

Likewise, great armaments had helped to keep the peace, provided they were not used. The instant one power began to mobilize in order to strengthen its diplomatic position, however, military men everywhere became nervous, for no general staff was willing to let a rival get much of a start. "Once the dice were set rolling," as Bethmann-Hollweg put it, nothing could stop them.

For subsequent declarations of war, see sections 15. *Diplomatic History of the War* and 17. *Chronology—Declarations of War*; consult also historical sections of separate articles on the various belligerents and biographies of the leading statesmen.

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#### 4. Comparative Strength of Belligerents

**Economic Power.**—By 1914, Great Britain, France, Germany, Italy, and the United States had become highly industrialized nations. Raw materials not available at home were readily obtainable in other lands, and adequate shipping had been constructed to meet transportation needs. The principal limitation to the capacity of these nations to produce armaments was a shortage of skilled workers. Japan and Belgium also had made great strides in industrialization, but Russia lagged behind and required major assistance from her allies to meet her war needs. Germany bore the additional burden of supporting her allies: Austria-Hungary required substantial aid, and Bulgaria and Turkey were almost wholly dependent on Germany for war materials.

At the outbreak of war, Germany lost her colonial empire, and, hemmed in by the Allied naval blockade, the Central Powers were in danger of strangulation. Moreover, the Allies waged intensive economic warfare to stifle the trade of the Central Powers with neutral European countries. Under these conditions the outlook for the Central Powers was dark, but they made up most of their deficiencies through territorial expansion and the exploitation of the resources of captured Allied areas. Their offensive in western Europe gave them control of Belgium and of the heavily industrialized area of northern France. They thereby gained the major portion of French steel, iron, coal, wool, and sugar production. Later, they acquired the resources and facilities of Russian Poland, Serbia, and Rumania, and when Russia collapsed in 1917, the rich granaries of the Ukraine and the Russian Baltic provinces also came under their control. Despite the Allied blockade and measures of economic warfare, the Central Powers were therefore capable of engaging in a long war. Shortages of skilled workers

were compensated for in large measure by the employment of women, who were found to be adept in many delicate phases of industrial production. The Allies also took advantage of these skills of women but to a lesser extent. When the United States with its vast resources and industrial capacity joined actively in the war, the balance of economic power swung sharply in favor of the Allies.

**Manpower.**—The greater population of the Allied countries gave them a distinct advantage over the Central Powers in the mobilization of manpower. The accompanying table presents an estimate of the numbers of men in the standing armies and trained reserves of the various belligerents when they entered the war and of the total number of men mobilized during the war.

MOBILIZED MANPOWER OF BELLIGERENTS

Countries	Standing armies and trained reserves	Total mobilized forces
<b>Allies:</b>		
Russia	5,971,000	12,000,000
France <sup>1</sup>	4,017,000	8,410,000
Great Britain <sup>1</sup>	975,000	8,905,000
Italy	1,251,000	5,615,000
United States	200,000	4,355,000
Japan	800,000	800,000
Rumania	290,000	750,000
Serbia	200,000	707,000
Belgium	117,000	267,000
Greece	230,000	230,000
Portugal	40,000	100,000
Montenegro	50,000	50,000
<b>Total</b>	<b>14,141,000</b>	<b>42,189,000</b>
<b>Central Powers:</b>		
Germany	4,500,000	11,000,000
Austria-Hungary	3,000,000	7,800,000
Turkey	210,000	2,850,000
Bulgaria	280,000	1,200,000
<b>Total</b>	<b>7,990,000</b>	<b>22,850,000</b>

<sup>1</sup> Including colonial troops.

**Armament.**—Neither side had unusual difficulties in meeting the needs for armament and equipment for their field armies. Industrialization had not progressed far in Russia, however, and she required substantial aid from her allies. The armament of the opposing forces was generally similar. Except for the tank, no revolutionary types of infantry or artillery weapons were introduced during the war. The Germans did construct a long-range gun, known as Big Bertha (q.v.), with which to shell Paris from a distance of 74 miles, but its effect was only one of harassment. Both opponents emphasized the machine gun, which, when used in conjunction with barbed wire and trench systems, was highly effective against infantry assaults. The artillery weapons of the opposing forces were largely comparable, but the French 75-mm. gun (especially when used by Frenchmen) was the deadliest weapon on the battlefield. The Germans respected it highly, and the American Expeditionary Force was equipped almost entirely with this weapon. With the introduction of the airplane on the battle scene, antiaircraft guns of up to 75-mm. caliber were developed in limited quantities by both sides.

The Germans tried to gain a decisive advantage by the employment of poison gas. When it was first used as the Second Battle of Ypres in 1915, it caused panic among the Allied troops at the front, and they fled. The German troops ran into their own gas, however, and halted the attack. Countermeasures were soon developed, and though both sides employed gas occasionally

throughout the war, its use had only nuisance value.

The Allies won a decided advantage with the development and introduction of the tank by the British in 1916. It was first used in the Battle of the Somme, where the approach of the monsters caused the German troops to drop their arms and flee in terror. The results of this first tank attack were not great, for only 36 units were employed, but the potentialities of the new weapon were readily recognized, and all the major powers hastily began to build them. The production of the Germans lagged, however, and they were never able to assemble enough tanks for a decisive drive. In contrast, Allied production and improvement of the tank advanced rapidly as the war progressed. In 1918 mass attacks by as many as 500 Allied tanks were not unusual, and they exerted a decisive influence on the outcome of operations. The tank played a major role in breaking the stalemate on the western front and in bringing the war to an end.

See also **ANTI-AIRCRAFT ARTILLERY; ARTILLERY—World War I; MACHINE GUN; POISON GAS; TANK—World War I Tanks.**

**Airpower.**—Airpower was in its infancy at the beginning of the war, for the types of aircraft available were crude and limited in purpose. The Germans had about 380 planes and 30 dirigibles (called zeppelins after their designer, Count Ferdinand von Zeppelin); the French had 120 planes and 10 dirigibles; and the British had a comparable small number of planes, with about 60 assigned to the British Expeditionary Force in France. Russia possessed only a few planes; and the United States as late as April 1917, when she entered the war, had only 55 planes, all of which were obsolete or obsolescent. Originally, the military purpose of the airplane was to provide observation and reconnaissance on the battlefield. When it was found possible to synchronize the firing of an automatic gun through a rotating propeller, the true value of aircraft as a fighting weapon was appreciated, and the race for construction began. Improved designs led to planes capable of carrying heavy loads. These were converted into bombers, and large bombs were produced. Initially, the Germans emphasized zeppelins, and their heavy bomber production lagged. Many zeppelin raids were conducted over France and England in 1915 and early 1916, but the dirigibles then became easy prey for the improved types of Allied fighter planes, and their construction was discontinued. German bomber production never equaled that of the Allies. Although their bombers struck London a few times and attacked installations on the Continent, the effect fell far short of the results achieved by the superior Allied formations. In view of the greater Allied production capacity, the Germans were generally at a disadvantage in the air on the western front except for occasional local concentrations in support of particular attacks. The aircraft production of Russia was small, and she was frequently inferior to the Germans on the eastern front. Toward the end of the war, Allied attacks on parts of the western front were supported by fleets of as many as 1,500 fighters and bombers attacking front-line troops and rear supply installations.

Many thousands of aircraft were produced during the war. Since available production figures often comprise all types of aircraft, including civilian planes, it is difficult to secure accurate

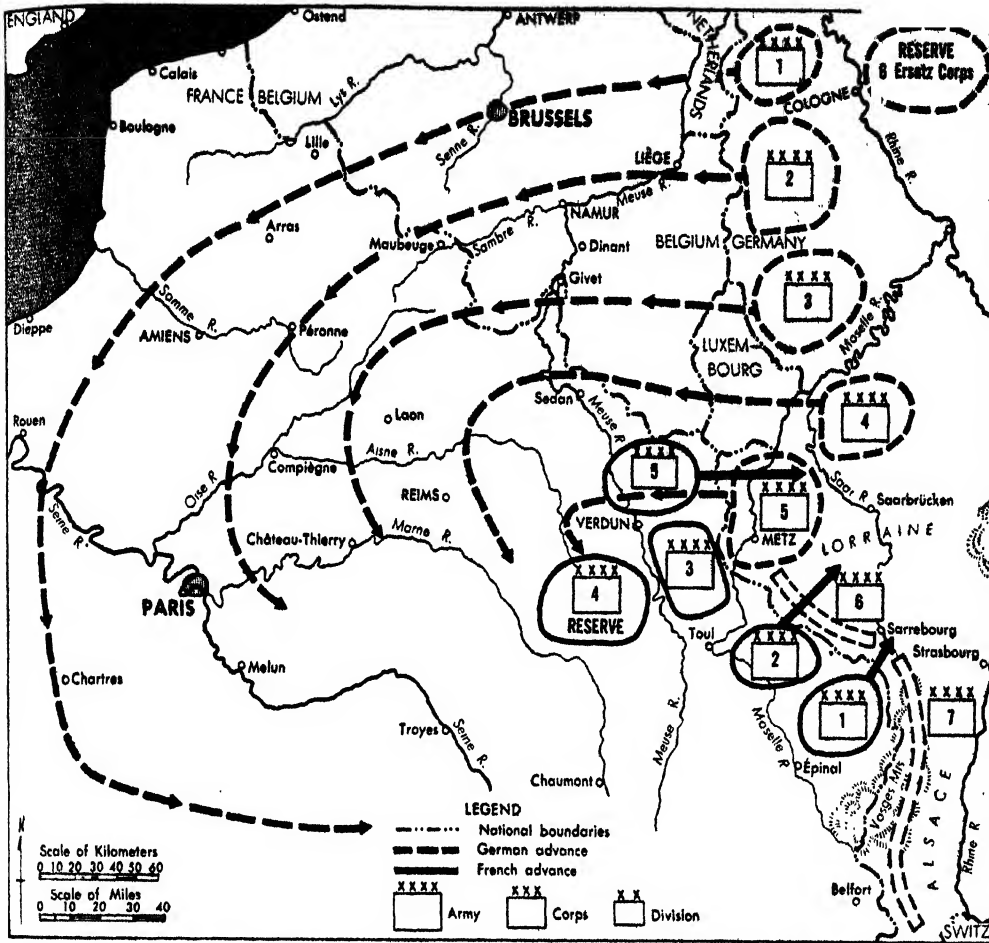
statistics of the purely combat aircraft produced. As an indication of the comparative air strengths of the belligerents in combat aircraft, those with the armies at the time of the armistice were as follows: French, 3,321; German, 2,730; British, 1,758; Italian, 812; American, 740; Austrian, 622; and Belgian, 153. The planes with the American forces were preponderantly British and French. When the United States entered the war, the Americans were urged by the French and British to concentrate on the production of engines and bomber planes, for designs of fighter planes were changing too rapidly to initiate production of any one type. The 12-cylinder Liberty engine was accordingly designed and adapted for mass production. A superb engine, it was in great demand by the Allies, and more than 30,000 units were built during the war. The Liberty engine was the greatest single contribution of the United States to World War I aviation.

See also section 14. *The War in the Air; AERONAUTICS—1. History (World War I).*

**Naval Power.**—In 1914, Great Britain was the greatest naval power in the world, and Germany was second. The total completed tonnage of the British Navy was 2,157,850; that of the German Navy, 951,713 (if tonnage under construction is included, the figures rise to 2,714,106 tons and 1,306,577 tons, respectively). When these figures are increased by the large navies of the other Allied powers and by the meager holdings of the German allies, it is evident that the Central Powers were hopelessly outclassed on the high seas. The relative strength in various types of warships of the British and German navies, respectively, was as follows: modern dreadnoughts and predreadnoughts, 40 and 33; battle cruisers and cruisers, 116 and 54; destroyers, 218 and 142; and submarines, 55 and 28. At the outbreak of the war the preponderance of the German High Seas Fleet was in home waters, where it was quickly bottled up by the superior British Grand Fleet. The 10 German cruisers on the high seas when war broke out were rounded up and destroyed, but not before they had sunk 5 British warships and 50 Allied merchantmen. The only hope of the Germans was to catch inferior portions of the British Fleet alone and thus to whittle down the disparity in naval strength. A sortie to this end was made in 1916, bringing on the Battle of Jutland, which resulted in a moral but unproductive victory for the Germans. No further major sorties were attempted.

The Central Powers were also greatly inferior in commercial shipping. In 1914 the commercial oceangoing steamships owned by the various nations had the following aggregate gross tonnages: Great Britain, 20,100,000; United States, 2,027,000; other Allies, 7,675,000; Central Powers, 6,325,000; and neutral nations, 6,640,000. Moreover, whereas Allied commercial shipping was free to roam the oceans, that of the Central Powers was restricted by the Allied blockade to inland waters under their control.

The submarine had been designed as an offensive weapon against major warships, and early in the war it was so considered even by the Germans. When it became evident that their navy was to be bottled up indefinitely by the British, however, the Germans turned to the use of the submarine for the destruction of merchant shipping. This was their last resort in an attempt to reduce the Allied advantage in shipping and thus to weaken the support of Allied land operations.



**SCHLIEFFEN PLAN AND FRENCH PLAN XVII.** The German Schlieffen Plan aimed to gain surprise by violating Belgian and Dutch neutrality; then, driving swiftly to get behind the French armies, the German right-wing armies would pin them against the Vosges Mountains. The German reserves were to follow closely and take over rear-area duties, so that the right-wing armies could remain at full strength for the coup de grâce. Count Alfred von Schlieffen's dying words are said to have been "keep the right wing strong." French Plan XVII called for drives on both sides of Metz, to liberate beloved Lorraine. It took cognizance of a possible German advance through Belgium, but it assumed that such an advance could come only east of the Meuse River. In this case, the Fifth Army was to move north of Sedan; its place in line would be taken by the Fourth Army. Note that the farther the French advanced into Lorraine, the more vulnerable the French armies would be to the German scheme.

The initial impact of the German submarine warfare was heavy, but the Allies developed the convoy system and other antisubmarine devices that proved fairly effective. Nevertheless, losses due to German submarine warfare were great, particularly in British shipping. Huge construction programs were inaugurated in British and American shipyards, and these succeeded in replacing most of the shipping destroyed.

See also sections 13. *The War at Sea* and 18. *Costs of the War*; SUBMARINE—5. *History of Submarine Warfare* (World War I).

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## 5. Western Front: 1914—Invasion and the Marne

### WAR PLANS

In the years before the outbreak of war in 1914, both the Germans and the Allies made plans for the struggle toward which the Euro-

pean tensions were leading.

**German Plans.**—The genesis of the final German plan for the war on the western front was the Schlieffen Plan of 1905, compiled by Count Alfred von Schlieffen, then chief of the General Staff. He was a disciple of Karl von Clausewitz, intent not merely on defeating the enemy but on actually destroying him, and his plan reflected this philosophy. Feeling certain that the French would devote their energies to recapturing Alsace and Lorraine (which they did), he envisioned a wide sweep to get behind them and pin them against the difficult terrain of the Vosges Mountains. To gain maneuver room for his massive encircling armies, he planned to cross the southern Netherlands and Belgium and break into France over her weakly defended frontier between Mézières and Dunkerque, where the French would not expect an attack because of the internationally guaranteed neutrality of Belgium. All possible strength was to be concentrated in the right-wing armies (the First and Second) of the enveloping force; the two armies on the Alsace-Lorraine front (the Sixth and Sev-

enth) would be strategically on the defensive, but they would try to lure the French on by limited attacks, thus keeping them occupied while the encircling armies closed in on their rear. At the appropriate time, the Sixth and Seventh armies would take the offensive and close the trap on the French. To maintain the full strength of the right-wing armies, special ersatz (substitute) corps were to be organized to take over rear-area duties as the advance progressed. The campaign was to be a lightning one of only a few weeks' duration; therefore, only small forces were to be left to confront the weak Russians. Ample time to deal them a death blow would be available after the conquest of France.

Schlieffen retired at the end of 1905 and was succeeded by Col. Gen. Helmuth von Moltke. Initially, Moltke retained the Schlieffen Plan, but he was soon confronted by a changing international balance of power. Russia had recovered rapidly from her defeat by the Japanese in 1905 and had expanded and improved her armed forces. Germany's ally under the Triple Alliance, Italy, whom Schlieffen expected to provide troops for his left wing, showed signs of faltering. The Saar coal mines and the Rhineland industrial area became essential to the German railroads and armament industry, and their protection had to be assured. These altered factors led Schlieffen himself to recommend in 1912 that the German Army be greatly strengthened for a simultaneous attack along the front from Belfort to the sea.

Moltke attempted to modify the Schlieffen Plan to meet the new conditions. First he decided not to violate Dutch neutrality—a laudable decision for political, ethical, and economic reasons. From a military point of view, however, this decision required the Germans to crowd their two large northern armies through the fortified bottleneck of Liège. Moltke made provision for greater forces to face the Russians and to protect the Saar and the Rhineland against the French. The net result of his modifications was that by 1914 the ratio of seven to one in favor of the right-wing armies, envisioned in the Schlieffen Plan, had been reduced to slightly less than four to one. While fault can be found with some of Moltke's changes in the original Schlieffen Plan, it was in his fumbling execution of the plan that he departed most sharply from its basic spirit, which was exemplified in Schlieffen's reported dying words, "Make the right wing strong."

**Allied Plans.**—The Allies had no precise plan to counter an invasion by the Germans. Belgium took her neutrality seriously and would not engage in war planning with her friendly neighbors. The British had worked in close collaboration with the French since 1911, and had agreed to send a British expeditionary force to the Continent to operate on the left of the French armies.

Since shortly after the Franco-Prussian War of 1870-1871, the French had been making and revising war plans to conform to changing circumstances. Plan XVI, in effect in 1911, provided for an offensive into Alsace-Lorraine to recover the lost provinces. Gen. Augustin Edouard Michel, then vice president of the Conseil Supérieur de la Guerre, considered the plan dangerous in that he believed that the Germans would advance through Belgium rather than through the difficult terrain on the Alsace-Lorraine front. He proposed a concentration on the Belgian border, between Lille and Rethel, ready

to undertake a vigorous offensive to drive the Germans from Belgium when they came that way. Such a plan involved the reorganization of the French Army and the possibility of unintentional violation of Belgian neutrality, however, and primarily for these reasons Michel's plan was rejected. He was replaced by Gen. (later Marshal) Joseph Joffre.

Despite certain personal eccentricities, Joffre was a man of strong personality and great firmness of character. These traits enabled him to gain the confidence of four successive war ministers to the extent that his control of the army became almost absolute. Under his leadership, Plan XVII, the plan in effect when war came, was prepared. Unlike the Schlieffen Plan, it was not a complete pattern of operations. It specified only the organization and concentration areas of the French armies and the intention to attack immediately. The First, Second, Third, and Fifth armies, in order from right to left, formed the first line. The Fourth Army was to the rear of the Third Army, ready to move to the latter's left if the Germans invaded Belgium (in which case the Fifth would move north to meet them) or to the right of the Third if the enemy moved through Switzerland. The Cavalry Corps was to be concentrated to the left front of the Fifth Army, ready to move into Belgium if the Germans came that way. The British Army, though not included officially in the plan, was to assemble on the left of the Fifth Army, around Le Cateau, if Britain entered the war. Once the concentration was completed, two major attacks would be launched: one generally south of the Metz fortified area, and the other north of it. No further details were given as to the attacks, since Joffre preferred to allow for changes in the situation.

It is evident that the French intended to do just what the Germans thought they would, and so make themselves vulnerable to the trap of the wide German envelopment through Belgium and western France. The majority of the French High Command recognized that the Germans might violate Belgian neutrality, but they believed that German strength would not permit operations west of the Meuse River without dangerous overextension. This conclusion was based on an accurate knowledge of the strength of the German Army, but its fallacy lay in an ignorance of the fact that the German Reserve units had been so highly trained that they could operate in the first line immediately after the outbreak of war. In sum, under existing circumstances Plan XVII was unsound. Michel's plan would have placed the French armies squarely in the path of the German wheel, thus avoiding the serious situation in which Joffre's armies found themselves in early September 1914.

#### THE OPPOSING ARMIES

**French Army.**—France, with a smaller population than that of Germany, had less available manpower. In consequence, whereas the Germans took into military service 50 percent of the men reaching the age of 20 each year, the French took about 80 percent. The German period of Reserve service was 5.5 years; the French period, 14 years. The French Territorial Army included men from 37 to 48 years of age; the maximum age of the men in the corresponding German Landwehr was 39. As a result, the Germans had the advantages of youth and of a



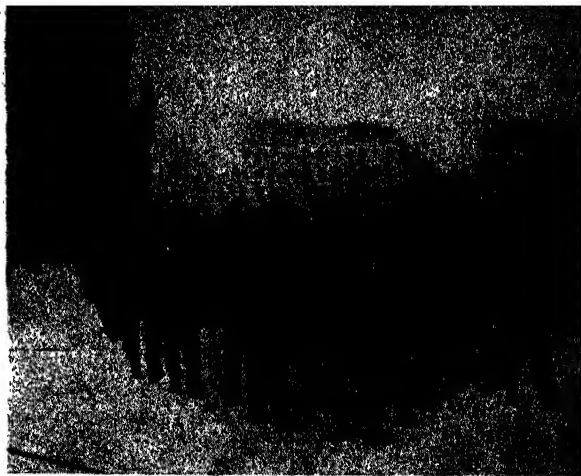
greater range of selection. The French Army had made tremendous strides since 1871, and by 1914 it was second only to the highly developed and precisely trained German Army. The French officer corps was generally devoted and highly capable, although it had become something of a political football. The Boulanger conspiracy, the Dreyfus case, and the anticlerical crusades all had affected the army, particularly the morale of the professional officers. Excessive civilian control had impelled some of them to seek promotion through political manipulation. Despite these unwholesome factors and an exceedingly low pay scale, most of the officer corps had remained true to its ideals. Years of hard work in schools, at headquarters, and with troops had developed excellent leaders and staff officers. Many of the French officers had had combat experience in colonial wars.

In tactical training the French Army lagged behind the German Army. Imbued with the philosophy of the attack ("*l'offensive à outrance*") as preached by Gen. (later Marshal) Ferdinand Foch, it had sadly neglected the teaching of defensive tactics. Consequently, the French were not highly skilled in field fortification, organization of the ground, and use of the machine gun and wire entanglements in the defense—areas in which German troops had received concentrated training. This do-or-die offensive spirit was to cause the decimation of the French officer corps.

In the category of artillery the French had the best weapon in the world in their 75-mm. field guns. Unfortunately, they had become so confident of this weapon that they had neglected medium and heavy artillery. When the fighting began, they had only about 300 guns larger than the 75-mm. gun, whereas the Germans had about 3,500. This discrepancy proved a serious handicap from the very first action and an even greater one when trench warfare began.

In round numbers the French armies employed in the opening campaign totaled 1,650,000 men. The fighting quality and, more especially, the recuperative power of the French soldiers were to prove an unpleasant surprise to the Germans, who had held them in low regard.

**German Army.**—At the outbreak of war the German Army was superior to other armies in organization, staff work, discipline, training, and equipment. It owed its superiority to a military tradition handed down from the days of Frederick the Great, and to the unstinted pride and support of Emperor William II and the German people as a whole. The efficiency of the army was due principally to the conscientious, hard-working cadre of Regular officers and noncommissioned officers. These men, carefully selected and trained and inculcated with a tradition of thoroughness, had so developed the young men of the country that after their two years of active service they maintained a very high standard in the Reserves. Reserve units were therefore able to take their place alongside Regular units at the outbreak of the war, to the surprise and chagrin of the French High Command. In addition to active, Reserve, and Landwehr units, the Germans formed a type called *ersatz* units, composed of men not suitable for the other units and designed to take over duties in the rear and on quiet fronts, thus releasing the better troops for more active employment. In round numbers the eight German field armies (including the one in East Prussia) that participated in the opening



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British Marines, dispatched to help the Belgians in the defense of Antwerp, arrive at Ostend in October 1914.

campaigns totaled 2,000,000 men.

In tactical training the Germans believed initially, as others did, that weapons of the day gave the advantage to the attacker. They did, however, heed the lessons of the Russo-Japanese War and trained their infantry intensively in defensive measures; this was to be of inestimable value when the front became stabilized. The German Army of the day was the best-equipped army. It had specialized in medium and heavy artillery, which other armies had neglected, and had developed a mobile siege train, consisting largely of 42-cm. howitzers, that proved its worth in the opening engagement of the western front by battering down the formidable defenses of Liège.

**British Army.**—The British Army in 1914 stood in sharp contrast to the Continental armies. The traditional military policy of Britain had been to have the strongest navy in the world and an army just large enough to police the colonial empire and protect the British Isles from invasion. British troops were all volunteers, Regular Army soldiers whose term of service was 7 years. They were highly trained and disciplined, were commanded by well-qualified professional soldiers, and had an *esprit de corps* superior to that of any Continental troops. Backing this regular force were home guards to defend Britain against invasion during the absence of the Regular Army, but they were too poorly trained and equipped to have combat value at the beginning of the war. The outbreak of war found Britain with only six infantry and one cavalry Regular Army divisions at home, ready for war, and five divisions overseas.

**Belgian Army.**—The Belgian Army, small and not highly trained or well equipped, was organized into one cavalry and six infantry divisions. Initially, it comprised 115,000 men in the field forces and 70,000 in garrisons. By the end of the war its numbers had increased to 267,000. It could not stem the German horde by itself, but it hoped to delay the German advance until the French and British came to its aid.

#### GERMAN INVASION OF BELGIUM

Moltke's decision to respect the neutrality of the Netherlands made it necessary for his huge First and Second armies, the hammer head of his wheeling movement, to pass through the narrow



(Above) U.S. Information Agency; (below) The Bettmann Archive

Above: The Civic Guard of Brussels barricades the Avenue Louise as the Germans approach the city in August 1914. Below: The first German troops enter Brussels on the afternoon of August 20. Their entry was unopposed, for the Belgian Army had withdrawn to Antwerp.

defile at Liège. Restricted on the north by the Dutch border and on the south by the rugged Forest of Ardennes, this defile was only a few miles wide. The valley of the Meuse and the formidable fortifications of Liège had to be overcome before the German armies could debouch into the open ground beyond.

King Albert I's plan was to assemble his entire field army along the Meuse between Liège and Namur and to hold the Germans along the river line as long as possible. His advisers, however, persuaded him not to risk the entire mobile army to annihilation at one stroke, but to assemble it behind the Gette River, a small stream about 30 miles northwest of Liège. There it could await the British and French and complete its preparations while the forts of Liège and Namur delayed the Germans.

Liège was considered one of the strongest fortresses in Europe. The city proper was protected by 12 forts, arranged in a ring 10 miles in diameter and dominating the terrain with their guns. Its position was very strong, but its garrison of 40,000 men was not large enough to defend adequately the intervals between the forts. The necessity for reducing Liège quickly had long been recognized, and the Germans had

made thorough preparations for the task. Selected units of the First and Second armies at full strength had been posted on the Belgian border for several years, and very heavy artillery to reduce the forts had been manufactured. The German plan was for these picked units, covered by artillery fire, to penetrate the intervals between the forts at several points, capture the city and the Meuse bridges there, and reduce the isolated forts one by one. Meanwhile, cavalry was to cross the river north of the city and attack the forts on the west side.

On the morning of August 4, the Germans assigned to reduce the fortifications crossed the frontier. The next morning, after the Belgian commander at Liège had rejected a summons to surrender, they began their attack. In attempting to penetrate between the forts, they found Belgian infantry hastily entrenched in their path. These troops fought bravely and, despite heavy losses, held the attackers to negligible gains. Meanwhile, the German cavalry succeeded in crossing the Meuse north of Liège. Realizing that the city would inevitably be encircled by overwhelming forces, the Belgian commander at Liège, Gen. Gérard Mathieu Leman, wisely decided to send the mobile division that King Albert had left with him to join the main army on the Gette, and to fight it out to a finish with his fortress troops. The city proper fell to the Germans on August 7, but the forts continued to hold out. On August 12, the attackers belatedly brought up their heavy siege artillery. Their 42-cm. howitzers, the heaviest artillery used up to that time, were too formidable for the forts, which had been built to withstand only 21-cm. fire. One by one they fell; the last two, on August 16. The westward march of the German First and Second armies began at once. Since the attack on Liège was made some time before German mobilization was complete and the armies were ready to move, Leman's admirable defense had not delayed the German advance for the full period August 5-16; actually, a delay of two or three days was effected.

The German First and Second armies then devoted their attention to the mobile Belgian Army under King Albert, but the latter proved elusive. By August 20, after skillful withdrawals, the Belgian Army, except for one division at Namur, was within the fortifications of Antwerp. On that day, the German First Army entered Brussels. At Antwerp the Belgians held a flanking position that the Germans were forced to mask with one corps, thus depleting the strength of the First Army.

#### BATTLE OF THE FRONTIERS

**Offensive in Lorraine.**—While the French completed their mobilization and concentration under Plan XVII, a corps of the French First Army invaded Alsace and captured Mulhouse on August 7-8. The jubilation of the inhabitants was short lived, for a counterattack by the Germans on August 9 drove the French back to their starting point. This minor defeat caused Joffre to modify his order of battle. The Mulhouse operation had been undertaken by Gen. Auguste Y. E. Dubail, First Army commander, who had not been able to direct it properly because of its distance from his headquarters. Foreseeing more such trouble, Joffre formed a new command, the Army of Alsace, of three corps, commanded by Gen. Paul M. C. G. Pau, who was called from

retirement. Its mission was to advance on the right of the First Army and to cover its flank.

Plan XVII was a general plan setting forth army concentration areas and declaring the intention to attack. On August 8, Joffre supplied details of the operations to come in his General Instructions No. 1. The First and Second armies were to launch an offensive northeastward into Alsace-Lorraine. Dubail's First Army, with its right protected by the Army of Alsace, was to capture Sarrebourg and drive the enemy toward Strashourg. Gen. Édouard de Curières de Castelnau's Second Army was to attack on Dubail's left. Opposing the French offensive were the German Sixth Army (Col. Gen. Josias von Heeringen) and Seventh Army (Crown Prince Rupert of Bavaria), both armies being nominally under the command of the crown prince. The latter, who was not a trained soldier, had been provided with a brilliant and forceful chief of staff, Gen. Konrad Krafft von Dellmensingen, who was the commander except in name.

It will be remembered that Schlieffen's original plan called for a fighting withdrawal of the two German left-wing armies. Moltke had modified the plan to provide enough strength for aggressive action. The Sixth and Seventh armies were to fall back fighting to the general line Morhange-Sarrebourg-Vosges Mountains, and when the French had committed themselves against this line, the German armies were to make a converging counterattack to drive the French armies back. The battle went almost exactly as the Germans had planned.

On August 14, the French offensive began. For four days the Germans fell back slowly, delaying with rear guards and artillery fire and inflicting heavy casualties. As the planned final line of resistance was neared, the German defense stiffened. Joffre, Castelnau, and Dubail all recognized the signs of the impending counter-offensive, but they were confident of breaking it up when it came. On August 20, the German blow fell, and in very heavy fighting the French were pushed back all along the line. The First Army fell back in comparatively good order, but two corps of the Second Army were nearly routed, and only the firm stand of General Foch's 20th Corps, the so-called Iron Corps, averted a disaster. For the next five days, the French were able to withdraw and establish themselves along the fortified heights of Nancy and behind the Meurthe River without serious German opposition.

Elated over the victory and believing the French armies to be so badly beaten that a vigorous drive would destroy them, Krafft von Dellmensingen pressed Moltke for permission to continue the offensive. Moltke agreed. In doing so, he was effecting a major change in the Schlieffen Plan, for he was trying to make a double envelopment instead of staking everything on a strong right wing. Under this new conception the German Sixth and Seventh armies were to dash themselves against the fortified heights of Nancy, the very region that Schlieffen had warned against as being unsuitable for major offensive action. Because it led Moltke into a false strategy, it may be said that the French defeat in Lorraine actually proved to be an advantage to France, for it tied down German troops and kept Moltke from sending them to his right wing, where they might have exerted a decisive influence.

**Battle of the Ardennes.**—According to Joffre's

General Instructions No. 1, while his First and Second armies attacked in Lorraine, the other French armies—the Third, Fourth, and Fifth—were to advance to the north through the Ardennes. This plan was based on Joffre's assumption that the Germans, lacking sufficient troops, would not advance to the east of the Meuse. But Gen. Charles L. M. Lanrezac, the Fifth Army commander, was convinced that this assumption was false and kept pressing Joffre for permission to move his entire army west of the Meuse and north into Belgium to meet the German enveloping force. When, on August 15, the Germans made a strong attack on Dinant, attempting to seize the bridges there, Joffre came around to Lanrezac's view and ordered him to move north into the angle formed by the Sambre and Meuse rivers. The Fourth Army then moved upon the left of the Third Army, approximately where the Fifth had been. This change of plan reduced Joffre's forces for the attack in the Ardennes from three armies to two, the Third and Fourth. To protect the right flank of the Third Army from any German attack from the fortified zone of Metz, Joffre formed the new Army of Lorraine, composed entirely of Reserve divisions and commanded by Gen. Joseph Maunoury.

The German Fourth and Fifth armies, forming the pivot of the great German wheel, had been moving forward slowly, regulating their advance on the speed of the hammer head, the First and Second armies. Their zones of advance were such as to bring them into collision with the French Third and Fourth armies. The clash occurred on August 22, two days after the great battle in Lorraine. The fighting took place along the narrow forest roads, where observation and liaison were difficult. The French pushed their attacks with persistence and vigor, suffering enormous losses. Finally, after three days of bloody fighting, they fell back. By August 25, the Fourth Army was retiring to the west side of the Meuse, and the Third was back approximately on its starting line, with its right flank in contact with the fortress of Verdun. On the following day, the Army of Lorraine was dissolved, two divisions being sent to the west to form the nucleus of the new Sixth Army at Amiens. German general headquarters received reports of a smashing victory, the impression being given that the French Third and Fourth armies had been almost eliminated. As a matter of fact, they had been beaten and had taken frightful losses, but they were able and ready to fight again.

**Battle of the Sambre.**—In accordance with Joffre's order of August 15, the French Fifth Army moved into the angle of the Sambre and Meuse by August 20. Meanwhile, some confusion arose as to its exact mission. On August 18, Lanrezac was advised that if the German right wing crossed in force to the west of the Meuse, his Fifth Army was to move northward to envelop it; if the enemy kept his main body east of the Meuse, the Fifth Army was to attack eastward across the river. In other words, Lanrezac was to be prepared to attack to the north across the Sambre or to the east across the Meuse, depending on where the German main forces were. Unaware of the location of the enemy, Lanrezac was perplexed. He did nothing until about noon of August 21, when he applied to Joffre for instructions. Joffre replied, "I leave it entirely to you to judge the opportune moment for starting

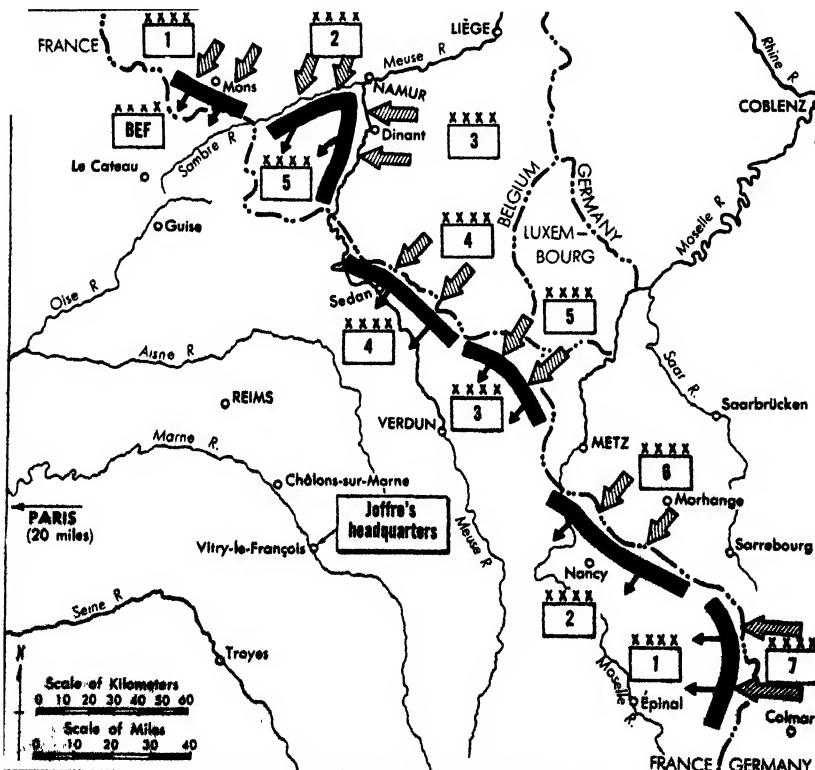
your offensive movement." Meanwhile, Lanrezac's troops were guarding the Sambre bridges, but in the absence of orders they did not cross to the north to establish bridgeheads.

At this time, Gen. (later Field Marshal) Karl von Bülow's Second Army was starting its wheel to the south and was headed squarely for Lanrezac's Fifth Army. The German Third Army, commanded by Col. Gen. Baron Max von Hausen, was approaching from the east. On the afternoon of August 21, advance units of the Second Army reached the Sambre and, finding the crossings weakly guarded, attacked. A bloody, disconnected battle, lasting all afternoon and into the night, ensued in the thickly built-up Sambre Valley. The Germans were held at some points but succeeded at others; in the end, they gained a foothold south of the river. That night, Lanrezac's corps commanders informed him that they intended to counterattack the following day and drive the enemy back across the Sambre. Lanrezac made no comment, and the attack proceeded. On the German side, Bülow directed his troops to hold their positions on August 22 and await the arrival of Hausen's Third Army on Lanrezac's right. The French attacks on that day were thrown back with heavy losses. Bülow then judged that he had enough strength to defeat the French Fifth Army without waiting for Hausen. His attack southward drove the French center and right back several kilometers by nightfall. Lanrezac then decided to attack northward on August 23 to envelop Bülow's left flank. For this purpose, he ordered his 1st Corps, which had been guarding the Meuse crossings, to move northward, leaving the crossings to be guarded by a Reserve division. Just as the 1st Corps was about to attack, its commander, Gen. Louis

Franchet d'Esperey, learned that the German Third Army had forced a crossing of the Meuse to the south. Since such a move would put it in the rear of the French Fifth Army, Franchet d'Esperey, without waiting for orders, called off his planned attack and sent advance units speedily southward to head off the Germans. They arrived in time, drove back the advance elements of the German Third Army, and temporarily stabilized the situation. That day, the Belgian division in Namur, foreseeing the fall of the city, moved out and took refuge behind the French Fifth Army.

Lanrezac correctly concluded that his army was in a serious plight and decided to withdraw—a decision which Joffre promptly approved. Bülow, believing that he was preparing a *coup de grâce*, ordered Gen. Alexander von Kluck (whose First Army had been subordinated to Bülow) to turn against Lanrezac's left, and requested Hausen to attack with his Third Army directly westward. Kluck did not receive the order in time, but Hausen attacked to the west as Bülow had requested. When the German blow fell on August 24, it fell on thin air, for Lanrezac had withdrawn his troops the night before. This Battle of the Sambre is sometimes called the Battle of Charleroi or Battle of Namur. It was a German victory, but the French Fifth Army, like the other technically defeated French armies, was by no means destroyed or neutralized.

The lack of decisive results for the Germans was due largely to a faulty command structure. Moltke tried to achieve coordination by subordinating the First Army to the commander of the Second Army, as he had done with the Sixth and Seventh armies in the east. This was inherently incorrect, for Bülow, concerned primarily with



**BATTLE OF THE FRONTIERS** (Aug. 14-24, 1914). This was the initial meeting of the main Allied and German armies on the western front. It consisted of four separate engagements: The British Expeditionary Force (BEF), rushing to the aid of the Belgians, met and was forced back by the more powerful German First Army in the Battle of Mons. Similarly, the French Fifth Army was driven back by the German Second and Third armies in the Battle of the Sambre. In the center the French Third and Fourth armies were repulsed by the German Fourth and Fifth armies in the Battle of the Ardennes. To the south the advance of the French First and Second armies in the offensive in Lorraine gained initial successes, capturing Sarrebourg and threatening Morhange, but counterattacks by the German Sixth and Seventh armies forced the French back across the border.

the operations of his own army, bent the efforts of the other armies toward its success and failed to see the picture as a whole. Hausen was not under his command, but since Bülow was a member of an ancient noble family of Prussia, the former deferred to his wishes without question. So far only the Russians had solved the problem of coordinating the efforts of armies by the establishment of army group headquarters.

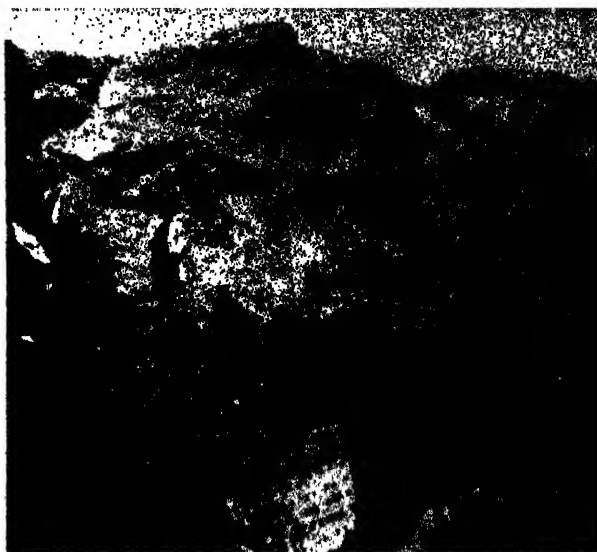
**Battle of Mons.**—On August 20, Moltke's headquarters advised Bülow that the British would eventually appear in the vicinity of Lille but that "no important debarkations have thus far taken place." Actually, the British had nearly completed their concentration in the Le Cateau area and were about to begin their advance into Belgium. Based on this erroneous information, Bülow ordered Kluck's First Army to change its direction of march from southwest to south in order to assure that his own Second Army would be supported in the coming Battle of the Sambre against Lanrezac's Fifth Army. Unfortunately for the Germans, this action was unwise, for Kluck's First Army struck the British Expeditionary Force (BEF) head on at Mons, whereas if it had continued on its southwesterly course, it would have enveloped its left flank, thereby altering the course of the entire campaign.

Field Marshal Sir John French (later 1st earl of Ypres), commander of the BEF, had moved with unprecedented efficiency. He had been instructed that, although he was not actually under Allied control, he was to cooperate with the French armies and base his strategy on theirs. On his way to Le Cateau, he visited Joffre and Lanrezac. The latter's manner irritated the British commander, generating an unfortunate relationship that was to lead to friction and lack of coordination.

On the night of August 22, the BEF took up a position at Mons. A gap of several kilometers between the British right flank and the left flank of the French Fifth Army was covered by a British cavalry brigade and by Gen. C. C. Sordet's exhausted French Cavalry Corps. British reconnaissance planes had reported heavy columns of German troops moving toward Mons that day, and when Lanrezac suggested that the British wheel to the right and strike the flank of the German Second Army, Field Marshal French declined to do so. It was well that he refused, because such a move would have presented the British left flank to Kluck's advancing First Army.

On the morning of August 23, Kluck's advance guards struck the British position at Mons. The ensuing Battle of Mons was a series of determined German attacks running into an equally determined British defense. The British Regular Army troops, though greatly outnumbered, stood their ground and gave the Germans a sharp lesson in expert marksmanship. Attacking in close formations, the Germans suffered severely from the British fire. By the end of the day, the British had been pushed back as much as five kilometers in some places but had held their ground in others. At nightfall they began to entrench their positions, intending to fight again on the next day, August 24. That night, however, French learned of Lanrezac's withdrawal and, believing it futile to stand alone, ordered a retreat that began before daybreak on August 24.

**Results of the Battles.**—These four actions—in Lorraine, in the Ardennes, on the Sambre, and at Mons—are collectively called the Battle



Militärgeschichtliches Forschungsamt

One of the 12 forts guarding the Belgian city of Liège, destroyed by 42-cm. German howitzers in August 1914.

of the Frontiers. The major fighting lasted only four days (August 20–23, inclusive), but French casualties exceeded 300,000, with appalling losses among the young offensive-minded officers.

Despite their heavy losses and reverses, the French soldiers maintained a surprisingly high morale. Among the general officers and higher staffs, however, the complete collapse of the French offensive plan had a demoralizing effect. But Joffre himself and his operations officer, Maj. Gen. (later Gen.) Henri M. Berthelot, maintained complete calm and confidence in ultimate victory. Now that they understood the German plan, the two generals set about to counteract it. Obviously, the BEF and the French Fifth Army were not strong enough to stop the German right wing by themselves and must therefore be reinforced. This could be accomplished by withdrawing elements from the right-wing armies, which were defending on good terrain and could spare the troops. These elements would be used to form a new army on the French left. On August 25, Joffre issued his General Instructions No. 2. The new army (the Sixth) was to assemble in the Amiens area; the BEF and the French Third, Fourth, and Fifth armies were to withdraw to the general line Somme River-Verdun, and be prepared to counterattack when they reached that line. This general plan eventually resulted in a successful counterstroke, though from a position much farther south of the Somme.

While Joffre realistically appraised the new situation and planned appropriate countermeasures, Moltke, elated by exaggerated reports of German successes, cherished the illusion that he had practically won the war. At this time, the Russians had invaded East Prussia with two armies, and the news from that front was not good. Moltke felt free to detach a corps from each of the Second and Third armies to send to East Prussia. The First Army had already been compelled to detach a corps to contain the Belgian Army in Antwerp, the Second had had to leave a corps to besiege the fortress of Maubeuge, and the Third had had to leave a division to besiege the little fort of Charlemont at Givet. Schlieffen had anticipated the necessity



for such detachments, and had provided for ersatz corps to follow and take over front-line duties so that the main attack could retain its full strength. Moltke had kept the ersatz corps in Germany and eventually assigned them to the armies on the Alsace-Lorraine front. By August 26, therefore, the three right-wing armies on which a decision depended and which had entered Belgium with 16 corps, had only 11 corps. On August 27, Moltke ordered a continuation of the general advance: the First Army to march west of Paris; the Second Army, directly on Paris; and the Third, Fourth, and Fifth armies, east of that city. The left-wing armies (the Sixth and Seventh), instead of remaining on the defensive and serving as a reinforcement pool for the right wing, were to continue the attack against the line of the Moselle River, break through, and form the eastern arm of a double envelopment.

#### BATTLES OF LE CATEAU AND GUISE

The resistance of Lanrezac's Fifth Army had stunned Bülow and caused him to hesitate, so that the Fifth Army had little difficulty in retreating. The British, however, were hard pressed by the iron-willed Kluck, who drove his First Army forward relentlessly. As a result, British troops were engaged daily in rear-guard actions.

**Battle of Le Cateau.**—Kluck was under the impression that the British were based on the Channel ports of Boulogne and Calais and kept trying to envelop their west flank to cut them off from their bases. Consequently, the left of the British line (the 2d Corps, under Gen. Sir Horace Lockwood Smith-Dorrien) was constantly under greater pressure than the right (the 1st Corps, under Gen. Sir Douglas Haig, later 1st Earl Haig). When the 2d Corps reached its assigned

position at Le Cateau, the Germans were in close contact at many points, and the British troops were exhausted by three days of marching and fighting. Haig's 1st Corps had not been as heavily engaged at Mons as the 2d Corps and had been under relatively light pressure thereafter. It therefore occupied its prescribed position at Le Cateau on the right of the 2d Corps without difficulty.

Smith-Dorrien felt that his troops were too nearly exhausted to continue the withdrawal, and decided to stand his ground on August 26 and retreat under cover of darkness on the following night. This decision brought on the biggest battle that the British Army had fought since Waterloo.

Advance elements of Kluck's First Army, believing that they were still pursuing the fleeing British, struck the British 2d Corps position early on August 26. Meanwhile, Haig had continued the retreat, so that Smith-Dorrien's right flank was completely open and his 2d Corps had to face east as well as north. The 2d Corps held its ground well in the center, but the right flank gave way and withdrew early in the afternoon, under heavy fire and with great loss. Soon the left flank was enveloped, and the 2d Corps was threatened with disaster if it did not withdraw immediately. At this moment, Sordet's Cavalry Corps came up from the southwest, diverting the attention of the Germans and allowing the British 2d Corps to withdraw. This corps had engaged German forces of more than twice its strength and is credited with having conducted a successful delaying action. The price was high, for it suffered casualties of 20 percent.

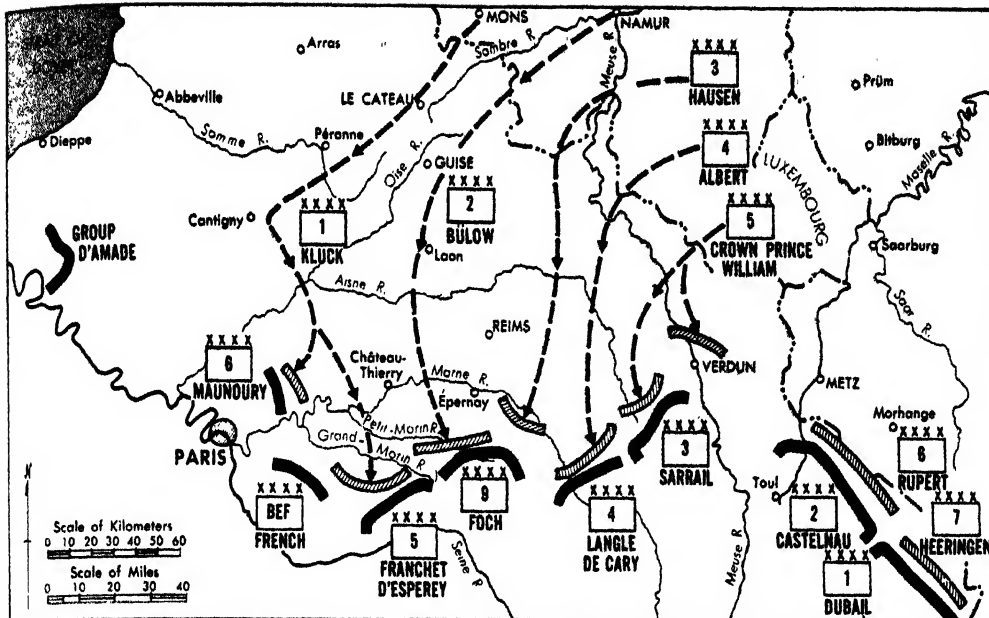
**Battle of Guise.**—During the fighting at Le Cateau, Joffre conferred with Marshal French and Generals Lanrezac and Albert d'Amade (commander of a group of French Territorial and Reserve divisions operating west of the British). Their reports were pessimistic and caused Joffre to doubt that the Allied forces could be organized along the line of the Somme for his counterstroke, as prescribed in his General Instructions No. 2. It began to appear that the retreat would have to continue, and that the counterattack would necessarily take place much farther south. On his return to headquarters he received a highly exaggerated report that the BEF had "lost all cohesion" and needed "serious protection." To take the pressure off the British, he ordered the French Fifth Army to attack westward and strike in flank the German elements attacking them.

Lanrezac received these orders with dismay. His Fifth Army was facing north to hold off Bülow's advancing German Second Army. In order to comply with Joffre's order, he would have to disengage his forces and face them to the west, thereby exposing his own flank to Bülow. Nonetheless, he disposed his forces to accomplish his new mission: two corps were ordered to face west, one to hold the original army front facing north, and the fourth to remain in reserve, ready to move either to the north or to the west as developments necessitated. Lanrezac asked French to cooperate in the operation by having the British 1st Corps make a limited advance northward, but the latter bluntly refused. In French's view, the operation was designed to gain a respite for the British, and he should take advantage of it. His refusal naturally made relations with Lanrezac even more strained than before. On August 29, Bülow's army arrived and attacked from the

British and Belgian troops retreat into France after the hard-fought Battle of Mons (Aug. 23-24, 1914).

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**GERMAN ADVANCE TO THE MARNE (Aug. 24-Sept. 5, 1914).** After the Battle of the Frontiers, the Germans continued their inexorable advance. The BEF was overtaken, and in the Battle of Le Cateau (Aug. 26) part of the force was badly defeated. A counterattack in the Battle of Guise by the French Fifth Army caused the German Second Army to halt for 36 hours and the German First Army to change direction to come to its aid. Meanwhile, Gen. Joseph Joffre worked feverishly to regroup his forces for a stand and counterattack, and began shifting troops to the Paris area. The change of direction of the German First Army took it east of Paris, where the French Sixth Army was forming for counterattack. Gen. Alexander von Kluck, German First Army commander, left a small detachment near Paris and continued to the Marne River. By Sept. 5, the opposing forces were located as shown on the map.

north. Lanrezac's attack to the west was unsuccessful, for the northernmost of the two corps making the attack was struck on its north flank and its westward movement was halted. The commander of the other corps, finding himself unsupported on his right, advanced timidly and failed to push his attack home. Later in the day, he retired behind the Oise River. The heaviest fighting took place to the north, on the original Fifth Army front. Here two German corps attacked with great vigor and drove back the French troops opposing them. Franchet d'Espèrey's 1st Corps, then in reserve, was thrown in, and in a general counterattack the Germans were driven north until darkness closed the battle. This was a fine tactical success by the Fifth Army, and French morale was greatly improved by it.

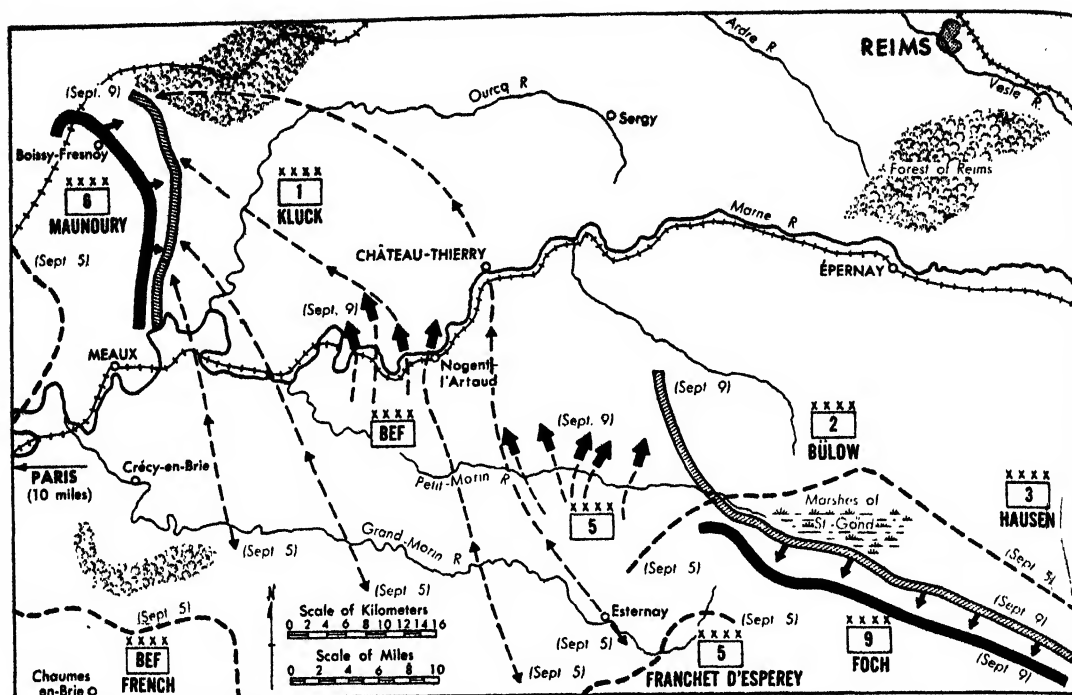
Although the German attack from the north had been halted, Lanrezac's own attack to the west had failed. About half of the German Second Army and all of the First Army lay to the west in a position to envelop Lanrezac's west flank if he remained where he was. He asked Joffre for permission to resume his retrograde movement, which was granted, and he did so on the following day. Lanrezac and his staff had done excellent work in getting the army into position for the battle, but once it was joined, as on the Sambre, army headquarters exercised little control. If the battle is considered from a higher level, Joffre obtained substantially the results he had hoped for, although the fighting did not go as he had planned. Bülow's Second Army was so badly hurt that it stood in place for a day and a half, thus allowing the BEF and the French Fifth Army to continue their retreat without interference. A secondary result was that Kluck's First Army made a drastic change of

direction of advance that was to have far-reaching consequences.

#### GERMAN ADVANCE TO THE MARNE

After the Battle of Le Cateau on August 26, Kluck continued the march of his First Army to the southwest, in accordance with Moltke's instructions to proceed toward the lower Seine River west of Paris. On August 30, he received a message from Bülow announcing that the French at Guise had been defeated "in a decisive fashion," and requesting Kluck to help exploit the victory by moving southeastward. (A few days previously Kluck's subordination to Bülow had been ended.) Kluck realized that Moltke should be consulted in this instance, but communications were so slow that several days would elapse before he could receive a reply. Meanwhile, the golden opportunity described by Bülow would have passed. Under the circumstances, Kluck decided to do as Bülow wished, but when he learned that, instead of continuing the pursuit on August 31, Bülow's Second Army would remain in place for a day, he became dubious about Bülow's "decisive" victory. Nevertheless, he reasoned that if Bülow was not going to press the advantage over the French Fifth Army, someone else should do so. He therefore pushed on toward the southeast, so as to pass east of Paris.

At his headquarters in Luxembourg, Moltke was almost completely out of touch with his armies. The BEF and the French Fifth Army had been routed, the French Third and Fourth armies were falling back (according to Joffre's plan), and the pursuing Germans met only slight resistance. As a result, Moltke and his army commanders were convinced that the French had been decisively defeated. It apparently occurred



**BATTLE OF THE MARNE (Sept. 5-9, 1914).** Finally apprised that the French Sixth Army was a major threat to his rear, Kluck ordered his troops to withdraw across the Marne to the French Sixth Army front. A wide gap was thus created between the German First and Second armies, defended only by weak rear guards and cavalry. Into the gap moved the BEF and the French Fifth Army, while Foch's Ninth Army held fast in the Marshes of St.-Gond to the east. With the right of their Second Army forced back and the rear of their First Army threatened, the Germans began a general withdrawal to the line of the Aisne River, 40 miles to the north. The troop dispositions shown on the map are those of Sept. 9, the critical day of the Battle of the Marne.

to none of them that the French withdrawal might be part of a preconceived plan. Spies had apprised Moltke of the arrival of large numbers of troops by rail and of intensive fortification activity in Paris, but he failed to transmit this information to the two field commanders most directly concerned, Kluck and Bülow.

Meanwhile, events caused Joffre to change his strategic plan. The British had been so cut up at Le Cateau that they needed additional time to recuperate. Maunoury's Sixth Army (formed primarily from units transferred from the eastern French armies) was not ready. In addition, Kluck's change of direction had been observed and reported. These changes in the situation induced Joffre to move the limits of the Allied retreat southward to a huge arc extending from Paris to Verdun and curving as far south as Nogent-sur-Seine. His General Instructions No. 4, issued on September 1, outlined this plan but noted that the retreat might not necessarily go so far. It provided also that the Sixth Army assemble for its counterstroke within the entrenched camp of Paris, to be temporarily under the command of the garrison commander.

On August 31 and September 1 and 2, Kluck drove his First Army southeastward as rapidly as possible, intent on fixing and destroying the left flank of the French Fifth Army. Because of his speed and Bülow's 36-hour halt after the Battle of Guise, the German First Army was now a full day's march ahead of the Second Army. Since Kluck was proceeding to the southeast and Bülow to the south, it appeared that Kluck's army could move behind the French Fifth Army while Bülow struck it from in front. The deci-

sive envelopment contemplated by Schlieffen would then become an accomplished fact. On the evening of September 2, as Kluck's 9th Corps reached the Marne River at Chateau-Thierry, he received orders from Moltke to follow the Second Army in echelon and protect the right flank of the German armies.

Moltke's order was motivated by his realization that the French forces at Paris had become formidable, and that sizable forces were needed to hold them off until the German envelopment of the main French armies had been completed. Again, however, he had failed to inform Kluck of the build-up in Paris. Kluck was in a quandary. Since he was already a full day's march ahead of the Second Army, to follow in echelon meant that he must halt for two days. It appeared to him that the supreme command wanted the French driven southeastward, away from Paris. Only his army was in position to do this, for the Second Army was not in close contact with the French, and even if it had been, could only have exerted frontal pressure. Because of poor communications with German general headquarters, Kluck once more made his own decision. This was to continue his attack southward. His 9th Corps had already seized the Marne bridges at Chateau-Thierry and was proceeding to cross the river; Kluck directed two additional corps southward, leaving two corps (later only one corps) north of the Marne to guard against any threat from the direction of Paris. This decision was to produce grievous results for the Germans. Kluck had violated the letter of his orders, but under the circumstances he thought that he was carrying out their spirit.

### BATTLE OF THE MARNE

**German Change of Plan.**—Reports of the shifting of French troops in large numbers from east to west and of great activity in the Paris area finally convinced Moltke that Joffre was preparing a counteroffensive. On September 4, he concluded that the Schlieffen Plan was no longer valid, because his First and Second armies were now too weak to overpower the French in the Paris region, and substituted a new plan. This provided that these two armies would face the eastern front of Paris to hold off the French there while his other five armies sought a decision. The Third Army was to drive directly to the south to rupture the French line, while the Fourth and Fifth armies were to drive southeastward to effect a junction with the Sixth and Seventh armies, which were to push southwestward in the Nancy region. The plan had some merit, but the weakened condition of the armies, occasioned by their rapid movement, and the greatly advanced position of Kluck's army south of the Marne doomed it to failure. Kluck received these orders on September 5. From his advanced position they seemed so illogical that he believed Moltke had been given erroneous information. Again he decided that it was best to push on south of the Marne and overtake the French Fifth Army, thereby adding to the complications of the over-all German situation.

**Joffre's Plan for the Counteroffensive.**—Joffre had determined the general pattern of his counterstroke as early as August 25, and he resolutely adhered to it despite reverses that made it impossible to launch his offensive as soon or as far north as he had hoped. Now, on September 3, conditions seemed ripe. By thrusting southeastward across the Marne, Kluck had put the German right flank in a perfect position to be struck by the French Sixth Army from the entrenched camp of Paris.

Before Joffre could order his counteroffensive, however, two difficult matters had to be resolved: the British had to be induced to participate in the operations, and the battered French armies had to be rehabilitated to regain their offensive power. The misunderstanding between Field Marshal French and General Lanrezac had caused the former to lose all confidence in the French Army and its leaders. French was con-

vinced that his army needed a period of undisturbed rest and a complete replacement of personnel and equipment losses before it would be fit for serious action. As a matter of fact, the British units, though tired and depleted in strength, had done no major fighting since the Battle of Le Cateau and were certainly in no worse condition than most of the French troops. Impervious to Joffre's appeals, French wired the 1st Earl Kitchener, British secretary of state for war: "I have no definite idea of General Joffre's general plan; its general result is the advance of the Germans and the retreat of the Allies." When Kitchener received this wire and others of a similar tone, he became alarmed and hastened to France on September 1 for an interview with French. There is no record of just what was said, but immediately thereafter French wrote to Joffre, suggesting that the Allies stand and fight, and thenceforth he was consistently in favor of attacking.

The rehabilitation of the French armies proceeded rapidly, for they were now close to their supply bases and replacement centers. From the beginning, Joffre had paid particular attention to the command structure. Disregarding friendship and political factors, he relieved any general officer whom he thought unfit for his job. Between August 2 and September 6, he replaced 3 army commanders, 10 corps commanders, and 38 division commanders. This weeding out naturally made many bitter enemies for Joffre, and very likely injustice was done in some cases, but the general effect of the widespread changes was good. The most controversial case was that of Lanrezac, whom Joffre replaced with Franchet d'Esperey on September 3. Lanrezac had had an outstanding peacetime record, had shown great strategic insight in divining German intentions, and had done excellent tactical planning. Some believe that he was a splendid leader, made a scapegoat to cover the derelictions of the over-all commander, Joffre. Others mark him as a man too small for his responsibilities, indecisive in action, and possessing an overbearing personality that not only bred resentment within his own command but so alienated Sir John French as to make cooperation between the French Fifth Army and the BEF almost nonexistent. His successor was a vigorous, self-confident fighter who

French infantry lines a ridge during Battle of the Marne (Sept. 5-9, 1914), in which the Germans were driven back.

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German soldiers stand at their gun positions in an open trench during Battle of the Marne (Sept. 5-9, 1914).

could inspire his troops and who got along well with the British. Under the new commanders the French soldiers took heart and determined to stop the invader at any cost.

On August 26, Joffre appointed Gen. Joseph Gallieni governor of Paris. While Joffre prepared his mobile forces for the decisive battle, Gallieni looked to the defenses of the capital. He was a dynamic and distinguished veteran of the Franco-Prussian War and the colonial wars. With energy and determination rare in a man of his age, he put the neglected defenses of Paris in order, strengthening forts and building field fortifications in the intervals. Maunoury's Sixth Army entered the fortified area on August 30 and was put under his control. Gallieni constantly prodded Joffre to set the army in motion eastward and stop the retreat. On September 3, the French government departed for Bordeaux, leaving Gallieni in complete control of Paris, where his dash and enthusiasm heartened the people.

Joffre's plan for his counterattack, as outlined in his General Instructions No. 6, was simple. The Sixth Army, moving out of the entrenched camp of Paris, was to advance north of the Marne and cross the Ourcq River early on September 6. At the same time, the BEF and the other French armies were to attack with determination on their respective fronts. If this great counterblow failed, little would be left to the French to carry on the war. Fully realizing this fact, Joffre for the first time issued a direct appeal to his men. It began: "As we engage in the battle upon which the safety of our country depends, all must remember that the time for looking backward has passed. . . ." His brief message was greeted with eager response in all ranks, and the French Army steeled itself for a supreme effort.

**Battle of the Ourcq.**—Maunoury's Sixth Army marched eastward on September 5, so as to be in position to cross the Ourcq the next day. At the same time, Gen. Hans H. K. von Gronau's 4th Reserve Corps of Kluck's army was advancing

southward along the west bank of the river toward Meaux. Soon Gronau received reports of strong French patrols and of several strong columns of all arms. He realized that something important was taking place to his right, but he lacked aviation and was weak in cavalry for scouting purposes. Deciding that there was only one way of learning the significance of the French activity, he ordered an attack to the west by his entire corps. Maunoury was not expecting to fight on September 5, and initially his leading elements were thrown into confusion. They soon recovered their poise, however, and a violent fight ensued. The Germans gained the upper hand and pushed the French back all along the line. By dark it was clear to Gronau that he was dealing with no mere reconnaissance force, and he therefore withdrew his exhausted troops to a strong defensive position about six miles eastward.

Notified of the battle, Kluck reluctantly started his 2d Corps northward to help Gronau. Neither the French nor the German higher commanders seem to have appreciated the importance of this fight. Gallieni reported it as "a small successful engagement," while Kluck sent only the 2d Corps to intervene. During the next day (September 6), Maunoury engaged all the troops he had available, attacking frontally and also endeavoring to envelop the enemy's north flank. Each attempted envelopment was met by another German unit from south of the Marne. Kluck, still unconvinced of the seriousness of the engagement on the Ourcq, sent only the 4th Corps north during the day in response to appeals from the commanders on the Ourcq, and refused to move his other two corps, which were under fierce attack south of the Marne. Finally, a copy of Joffre's attack orders was picked up by the Germans on the battlefield. This made it clear that Maunoury was conducting a major offensive, and Kluck ordered his two corps on the Marne north to the Ourcq. Although their movement widened an already existing gap between the German First and Second armies, Kluck was confident that the British did not present a serious threat to the Germans. He admired the fighting qualities of the British troops, but since Le Cateau they had not paused in their hasty retreat, and he reasoned that they were unlikely to make a dangerous thrust at this time.

Meanwhile, Maunoury pressed his attacks vigorously on September 7 and 8. Gallieni rushed reinforcements to him from Paris, including two regiments of infantry sent in taxicabs.<sup>1</sup> Possessing numerical superiority, the French retained the initiative despite the arrival of Kluck's other two corps, but they gained little ground. On the evening of September 8, Kluck ordered a coordinated attack for the following day, stating: "The decision will be obtained tomorrow by an enveloping attack on the north wing. . . ." At the same time, Maunoury, having committed all of his troops and knowing that additional German forces had arrived, ordered the Sixth Army to pass to the defensive on September 9, and secretly directed his senior subordinates to prepare plans for a step-by-step retreat toward Paris. Victory seemed about to reward Kluck's fighting

<sup>1</sup> Contrary to the popular impression at the time, this spectacular movement did not have an important influence on the battle, but it was significant in that it was the first movement of troops to a battlefield by motor transport.



spirit and iron determination, but events elsewhere had already made German failure inevitable.

**Battle of the Two Morins.**—Franchet d'Esperey's Fifth Army, beginning its advance on September 6 as scheduled, encountered Kluck's two corps south of the Marne. Fighting raged from noon until dark, when the Germans broke contact and withdrew to the line of the Grand-Morin River. Meanwhile, Franchet d'Esperey's right corps advanced unopposed to its objective for the day, but it was then struck by one of Bülow's corps and driven back. The first day's fighting by the Fifth Army thus was indecisive: Franchet d'Esperey now ordered a general advance for September 7. On that day, Bülow, fearful for his exposed right flank, ordered it behind the Petit-Morin River. The French followed up the withdrawal and attacked the new line unsuccessfully on September 8. By that time, Kluck's last two corps had moved northward to the Ourcq and were no longer supporting Bülow. His afternoon attack having failed, Franchet d'Esperey decided to attempt an attack that evening. The night attack was a complete success, piercing Bülow's line and forcing him to withdraw about six miles to a position facing west.

This movement so widened the gap between Kluck and Bülow that it could not be closed. Only two cavalry corps, aggregating about 10,000 men, were available to defend the gap. The British moved forward on September 6, but since they had retreated so far, their advance began from a position considerably behind the point from which Joffre had hoped they would start. Field Marshal French seemed in a position to strike a fatal blow to the Germans through the gap on his front between their First and Second armies, but his advance was slow. While the troops were eager to fight, their commanders, remembering Mons and Le Cateau, were overcautious. The small German cavalry forces were handled with great skill, and it took the British three days to cover 25 miles. By the evening of September 8, the British had advanced to within artillery range of the Marne; that afternoon, Kluck's last two corps, the 3d and the 9th, crossed to the north of the Marne en route to the Ourcq.

The British advance into the gap, though much too slow, had put the Germans in a critical position. The British troops were nearing Kluck's rear, while Franchet d'Esperey's Fifth Army was in a position to envelop Bülow's right flank. For the Allies to exploit this favorable situation, however, it was necessary for Maunoury's Sixth Army to hold its own against Kluck's attacks on the Ourcq and for Foch's Ninth Army to prevent Bülow's left and Hausen's Third Army from breaking through.

**Battle of the Marshes of St.-Gond.**—Foch's Ninth Army (newly created from units of the eastern French armies) was scheduled to participate in Joffre's general offensive by attacking northward, but during most of the battle it was compelled to stand on the defensive because from the outset it was attacked by superior forces. In order to face Paris, as prescribed in Moltke's new plan, Bülow had to pivot on his right. In so doing, his two left corps ran into Foch's left and center. Hausen, driving his Third Army southward in accordance with Moltke's orders, ran into Foch's right. The French Ninth Army thus found itself in the path of the main efforts

of two German armies. Its position was strong in the center, fairly good on the left, and weak on the right. On September 6, Foch was fully occupied on his left and center with Bülow's troops. The French left held, though only with difficulty; the center, under fierce attack, was forced south of the marshes, where it then held. On September 7, Bülow resumed his attacks, and Hausen joined him against Foch's right, but the Ninth Army remained firm. The fighting was bloody and bitter all along the line; in the open terrain on Hausen's front the French light artillery was especially effective. Although Foch had considerable cause for concern, he held on.

Hausen decided to avoid the devastating French artillery fire by making a large-scale surprise night attack. Such an attack was a highly unconventional procedure at this stage of the war, and most of the German commanders thought it foolish. Nonetheless, Hausen attacked with four divisions at 3 A.M. on September 8, moving the infantry forward in the moonlight with fixed bayonets, unloaded rifles, and no artillery preparation. This innovation was a huge success. The attack swept three miles forward, throwing three French divisions into confusion and capturing 28 pieces of artillery. It seemed that the Ninth Army was crushed, especially when Bülow renewed his attacks against its left and center. Foch met the emergency by peremptorily ordering his hard-pressed troops to attack, which served to eliminate the possibility of retreat from their minds. French determination and German exhaustion, caused by two days of bitter fighting following weeks of hard marching, finally brought the enemy advance to a halt. It was at this critical time that Foch purportedly sent his famous dispatch to Joffre: "Hard pressed on my right. My center is yielding. Impossible to maneuver. Situation excellent. I attack."

Foch's Ninth Army had another hard day on September 9. Hausen, assisted by Bülow's left corps, launched violent and repeated attacks throughout the morning, determined to crush the French. Foch's troops were gradually driven back along most of the line, but, inspired by a series of imperative orders for local counterattacks and by news of successes gained by the French armies to the west, they held, though almost at the breaking point. Franchet d'Esperey lent some troops from his Fifth Army to Foch, and with these the latter was able to fill gaps in his line where necessary and to counterattack. Nonetheless, defeat still seemed imminent. At this critical juncture the German attacks lessened and then ceased. The German High Command had decided to withdraw from the Marne. Foch's stand is a classic example of self-sacrifice without hope of gain in order to make victory possible elsewhere.

**Fighting to the East.**—While the BEF and the French Fifth and Ninth armies engaged the Germans in the critical area of the Battle of the Marne, the French First, Second, Third, and Fourth armies to the east played their parts well in the over-all plan. Gen. Fernand L. A. M. de Langle de Cary's Fourth Army, after its defeat in the Battle of the Ardennes, had retreated step by step. On September 5, when it received Joffre's order for battle, it was between Foch's Ninth Army on the left and Gen. Maurice P. E. Sarrail's Third Army on the right. There were large gaps on both sides of the Fourth Army, which Langle de Cary lacked the troops to close:

His primary task, therefore, was to prevent the Germans from exploiting the gaps. Opposing him directly was the German Fourth Army under Albert, duke of Württemberg, and to the east of the latter was the Fifth Army under German Crown Prince William.

The battle opened on September 6 and for three days raged furiously. The German attacks were mainly frontal, and the French succeeded in stopping them; on the other hand, Langle de Cary's troops could not advance. Albert and the crown prince debated about which gap on Langle de Cary's flanks should be exploited. Moltke was requested to settle the dispute and, apparently not wishing to become involved between the two princes, replied: "It is desirable that the Fourth and Fifth armies lend each other mutual support." While these discussions were being held, reinforcements arrived from Lorraine, and the gap on Langle de Cary's left was closed. The princes then decided to attack the gap on his right, but Langle de Cary's right corps had stretched its front eastward so that the German attack became frontal. Being overextended, this corps was forced gradually to give ground, although it fought tenaciously. Relief came on the night of September 10, when the German Fourth Army broke off contact and withdrew to the north.

Sarrail's Third Army had retreated from the Ardennes until, on September 6, it occupied a position facing northwest with its right wing resting on the fortress of Verdun. When it moved forward that day to attack as Joffre had directed, it encountered the German crown prince's Fifth Army. Fierce combat continued for four days, during which time William tried unsuccessfully to exploit the gap between Sarrail's and Langle de Cary's armies. He then attempted to cross the Meuse south of Verdun in order to take Sarrail in the rear, but he could not subdue the little forts at the crossing points. On September 10, he returned to his attacks west of Verdun, but failed there also and withdrew northward.

The fighting on the front of the French First and Second armies was almost continuous from the opening of the Battle of the Frontiers to the end of the Battle of the Marne. After the Germans smashed the great French offensive in Lorraine on August 20, they followed up slowly and, on August 24, launched a drive that they hoped would carry them across the Moselle to penetrate the French lines. The French First and Second armies had recovered rapidly from their initial defeat, however, and in a counterattack not only stopped the Germans but hurled them back. There was a lull in the fighting from August 28 to September 3, during which time Joffre moved out large bodies of troops to bolster his threatened left. On September 4, in conformity with Moltke's revised plan, a strong German attack was directed against the heights of Nancy. Determined attacks were made until September 10, but to no avail, for the French, though inferior in strength, were in excellent defensive positions. Moltke finally realized that Schlieffen was right in that Lorraine was not a suitable area for major operations. He called off the attacks and began to move the Seventh Army to his weakened right on the Aisne, while the Sixth Army withdrew toward the frontier.

**German Retreat.**—When Moltke learned that Joffre had ordered a general offensive for Sep-

tember 6, he was pleased, because he was confident that if the French would only stand and fight, his armies could destroy them. On September 4, he had issued directives describing how the Allied forces were to be destroyed. All he could do now, he felt, was to rest at his headquarters in Luxembourg and wait for his orders to be executed. Communications between headquarters and the front were inefficient, and it was not until September 7 that he learned of the gap developing between his First and Second armies. Since it was obvious that general headquarters would now have to intervene, Moltke sent his chief of intelligence, Lt. Col. Richard Hentsch, to the right-wing armies to secure a complete picture of the situation. Moltke recognized that one or more of his strong-minded army commanders might already have begun a retreat, and he therefore authorized Hentsch to issue in his (Moltke's) name such orders as might be necessary to coordinate the withdrawal, close gaps in the line, or halt the rearward movement at a strong defensive position. These instructions were not reduced to writing, a fact that has caused much controversy.

On September 9, at Bülow's headquarters, Hentsch was informed that the German Second Army was in a precarious position (as it was) and would retreat behind the Marne and then behind the Vesle. He next traveled to Kluck's headquarters, about 50 miles away. Kluck was in the midst of his attack to envelop Maunoury's northern flank, and the attack was progressing well, but Kluck's southern flank had to be drawn back to avoid its envelopment by the advancing British. Hentsch invoked his authority and ordered that a retreat begin before the First Army was trapped. The attack was then halted.

When Moltke received Hentsch's personal report on the afternoon of September 10, he immediately ordered the right-wing armies (First, Second, and Third) to fall back and the others to halt. On the following day, he decided to visit the front, for the first and only time during the campaign. The impressions he gained on this trip were so unfavorable that he ordered a retreat to the general line Noyon-Verdun, which was to be fortified and defended. The German withdrawal was effected with little interference from the Allies. Severely tried by their marching and fighting, the latter failed to make a vigorous pursuit, thereby losing many of the fruits of victory. By September 14, the German armies were organizing their new prescribed positions for defense, and the Marne campaign was at an end. On that day, Moltke was relieved of his command by William II and was replaced by Gen. Erich von Falkenhayn. This change was kept a secret because it amounted to an admission of failure. To prevent the news from spreading, Moltke was required to remain at general headquarters until November 1, when his replacement was announced openly.

#### CONCLUDING OPERATIONS OF 1914

**First Battle of the Aisne.**—Although their pursuit was so slow that they lost contact at many points, when the Allies arrived before the new position on the Aisne, they attacked with vigor. The German position was on high ground about two miles north of the river. Spurs ran from this ground to the Aisne, giving the Germans surveillance of the river crossings. The Allies crossed the Aisne on September 13 against little resist-

ance, and the next day began a general offensive, with the British making the principal effort. Bitter fighting continued with negligible gains until September 18, when Joffre stopped the attacks.

This battle marked a transition from the open warfare that had preceded it to the stabilization of the front that ensued. It was the first battle in trench warfare and the forerunner of many such battles to come. The Germans had chosen and skillfully organized one of the strongest positions on the western front. Here they reaped the full reward of their prewar defensive training. Their skill with grenades, machine guns, and field fortifications gave them a great advantage in this type of fighting. Artillery came into its own in the battle. In such a stabilized situation the artilleryman had ample time for registration, and he developed great accuracy. Adjustment of artillery fire by airplane later became commonplace, and the consumption of ammunition reached rates unforeseen by prewar planners. The lack of medium and heavy artillery counted strongly against the Allies, for many targets in the rough hill mass before them could not be reached by their light, flat-trajectory field guns.

**Fall of Antwerp.**—Stabilization of the main battlefield on the Aisne left the Germans with their west flank near Noyon open and vulnerable. Behind them lay Antwerp with the entire Belgian Army of approximately 150,000 men. In order to relieve this dangerous situation, Falkenhayn ordered the city reduced at once. The Allies, especially the British, were anxious to hold Antwerp, hoping that the main line of battle eventually could be extended to include it, but it was difficult to send help. Actually, they had little to send, and they could not move what they had up the Scheldt by ship, for the neutral Netherlands controlled the mouth of the river and would not

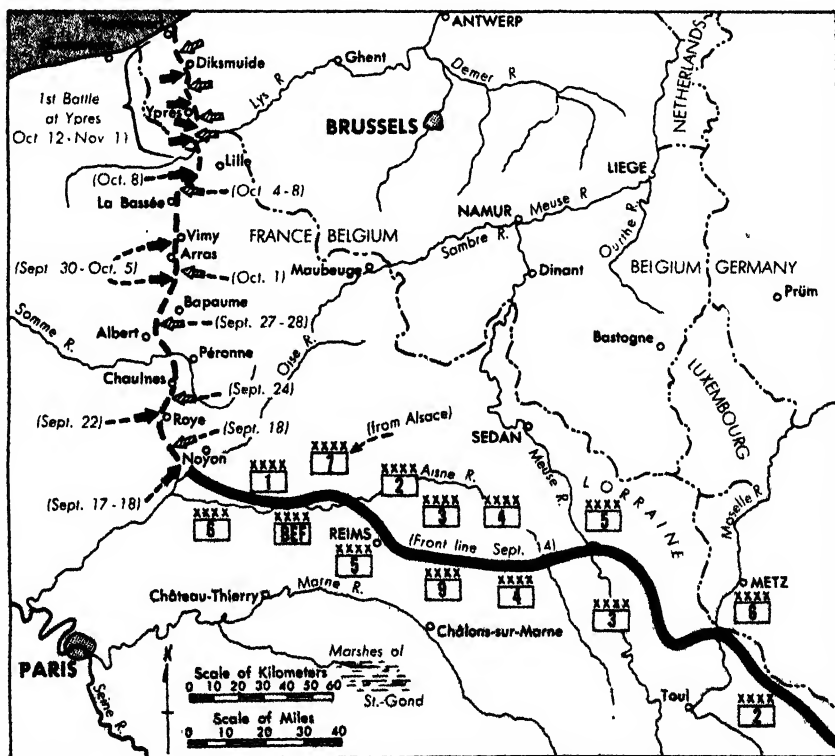
permit them to adopt this course.

The city had been considered one of the strongest fortresses in Europe, but the forts were easy prey for the heavy siege guns of the Germans, which knocked them out one by one. On October 8, King Albert moved out with the mobile army. Three days later, the city fell despite the efforts of Winston Churchill, first lord of the admiralty, who arrived with the Royal Naval Division, consisting of a brigade of marines and two brigades of naval Reservists. Two divisions of trained British Army troops had reached the vicinity of Bruges on October 6, and had started up the coast to lend their assistance at Antwerp. Meeting the retreating Belgians and Royal Naval Division, they fell back with them toward Ypres (Ieper).

**Race to the Sea.**—The successive operations that took place in September and October 1914 are commonly called the Race to the Sea, but the title is misleading. Neither contestant was trying to reach the sea; each was attempting to envelop his opponent's flank. In mid-September, when the Aisne front began to be stabilized, each side began to shift troops from east to west in an effort to envelop the other. Each attempt was successfully repulsed by the enemy, and the result was a series of bloody battles extending successively northward as the newly arrived forces collided. In the course of this maneuvering the BEF began a movement from the Aisne front to the vicinity of Ypres in Flanders.

**First Battle of Ypres.**—When the left flank of the Allied forces reached the sea, Falkenhayn decided to penetrate their lines in the vicinity of Ypres before they could organize their positions properly. This seemed an opportune time, because the front at Ypres and to the south was only lightly held pending the arrival of the bulk

**FIRST BATTLE OF THE AISNE AND THE RACE TO THE SEA.** After the Battle of the Marne the Germans withdrew to formidable positions along the Aisne. When their repeated frontal attacks against these positions failed, the Allies attempted to envelop the German flank on the north. This initiated a series of enveloping maneuvers by both sides, each determined to outflank the other, without significant success. Meanwhile, the front extended farther and farther north. The final clashes took place between the Lys River and the English Channel coast in the First Battle of Ypres (October 12–November 11). The Germans and Allies strove desperately to succeed in this last opportunity for envelopment. Fighting was bitter and bloody; heavy losses were sustained by both sides, but gains were insignificant. Exhausted, the opponents began to dig in and strengthen the positions held; trench warfare, which was to frustrate the Allies and Germans alike for almost four years, had begun.



of the BEF, which was then moving up from the Aisne. On October 12, Falkenhayn threw his full strength against the Allied position at Ypres, hoping to drive through to the Channel ports. For nine days he pressed his attack with vigor. On several occasions it seemed that the thin Allied line would break, and Joffre sent Foch to Flanders to coordinate the defense. While Foch had no command authority over the Belgians or the British, he did control the French reinforcements that were being sent to the north as rapidly as possible. His strong personality and determined fighting spirit soon gave him such influence over Field Marshal French that he was, practically speaking, able to direct operations as an Allied commander. This development was fortunate, for a firm coordinating hand was essential. The Germans had great superiority in numbers and artillery, but they were finally stopped.

On the left flank the Belgians opened the sluice gates in an effort to halt the Germans. An area two miles wide extending from Diksmuide to the sea was inundated to a depth of three or four feet, halting the German advance. The fighting there was bitter, however, and the Belgians lost 35 percent of their strength.

By October 20, the German attacks had been entirely stopped. Foch and French reasoned that the enemy must be exhausted, and since the entire BEF had now been assembled together with many French units, the Allied commanders decided to attack in their turn. This proved to be a costly error, for heavy rains were setting in, and the low-lying plain of Flanders was rapidly becoming a swamp. Furthermore, the Germans had brought up reinforcements and were in the process of bringing up more. The Allied attacks persisted with frightful losses until October 28, when Foch halted them.

On the following day, Falkenhayn, who had amassed a superiority of about six to one at the point of attack, resumed the offensive. A breakthrough was achieved in the British line south-east of Ypres on the third day of the offensive, but, by throwing in all of their reserves, the Allies managed to hold firm. Falkenhayn kept pressing his attacks to no avail until November 11, when heavy rains and snow finally brought them to an end.

The fighting at Ypres left the British in an unfavorable defensive position. This was a salient six miles deep with the town of Ypres at the center of its base. The Germans held positions on the surrounding hills that gave them excellent observation over the entire salient. The area was so low that construction of entrenchments was difficult, ground water being struck in many places at a depth of one foot. A far better defensive position would have been one extending north and south just behind Ypres, giving up the salient and the town. Ypres had become a symbol of Allied resistance, however, and the effect on public opinion of withdrawing would have been unfortunate. Accordingly, the troops held on to the town year after year.

**Stabilized Front.**—Ypres was the last major battle on the western front in 1914. Both sides dug in, and trench warfare began to take on the form that was to become so familiar in the next four years. In the autumn of 1914, however, the elaborate systems of field fortifications that were developed later were unknown. Over most of the front the trench system consisted of an irregular ditch with a depth equal to the height of a man

and another such ditch 200 or 300 yards to the rear. The forward trench was called the front line, and the one in the rear the support line. The area between the opposing positions was known as no man's land; it might vary in width from 30 to 800 yards. From the beginning the German defenses were superior to those of the Allies. They generally had been located with due regard for terrain, fields of fire, and observation, whereas the French and British front line was simply the place where the foremost troops had dug in at the end of an attack. The Allied policy was that ground once gained must never be given up (a good enough principle in its place), and this policy was vigorously enforced. As a result, the Allied positions, as at Ypres, were often poorly sited in sectors where excellent positions existed a short distance to the rear.

From the crude beginnings of 1914 both sides eventually evolved elaborate defensive systems, the German defenses usually being better than those of the Allies. With typical thoroughness the Germans constructed deep belts of wire entanglements, large dugouts where platoons and companies could find shelter from the heaviest bombardment, concrete pillboxes, and telephone and electric light systems.

When no major attacks were in progress, life in the trenches varied from extreme misery to passable comfort. Mud and cold brought great hardship, especially during the first winter, because neither side had yet learned the techniques of trench living. On the British front the offensive spirit was kept alive by constant patrolling, raids, mine warfare, and sniping. Except during offensives, the French were more inclined toward the tacit encouragement of a policy of live and let live, while the Germans adapted themselves to their opponents.

The breakthrough of enemy positions was to remain a dream for nearly four years. The line established in November 1914 did not move as much as 10 miles in either direction until February–April 1917, when the Germans voluntarily withdrew to the Hindenburg Line. Innumerable attacks, costing hundreds of thousands of lives, were to be launched with little or no result.

#### 1914 IN RETROSPECT

The Schlieffen Plan and Plan XVII both failed completely. Under prevailing circumstances, Plan XVII was unrealistic and never had a chance of success. An erroneous estimate of the number of mobile German troops available caused General Joffre to minimize German capabilities for major operations west of the Meuse. The French attacks were directed over terrain highly unsuited for major offensive action. Moreover, an unreasonable faith was placed in the deeply inculcated French offensive spirit; 80 percent of the infantry officers were either killed or wounded during the first five months of the campaign. Joffre was responsible for the disastrous Plan XVII, but when his preconceived ideas collapsed in the Battle of the Frontiers, he did not lose his head or show signs of discouragement. Instead, he faced the situation calmly and shifted forces to the left wing for a counterblow. His control of his armies was close and intimate throughout the campaign. He had good communications and used his liaison officers freely. As a result, he was always familiar with the situation, and his subordinates were never in doubt as to what he wanted done.

The Schlieffen Plan depended for success on close control, speed of execution, and a strong encircling right wing. It failed primarily because of General von Moltke's lack of direction and control, for which inadequate signal communications were partly to blame. It is difficult to understand why the Germans, ordinarily precise and well prepared, neglected this vital field of military support. Moltke remained aloof in his headquarters far to the rear and let his subordinates have their own way. As a result, they not only failed to cooperate with each other but did not follow the strategic plan. All German commanders fell into the error of interpreting their successes at the frontier as decisive victories, and the planned French withdrawal as a rout. The exaggerated reports of success prejudiced the German operations in many ways. They led Moltke to give way to the importunities of Prince Rupert and General Krafft von Dellmensingen, and allowed them to hurl large numbers of Germans against small numbers of Frenchmen in good positions in the difficult terrain of Lorraine and the heights of Nancy, so that Joffre could assemble superior power on his left wing. Considering how close the French came to breaking on the Ourcq River and at the Marshes of St.-Gond, it seems reasonable to suppose that the additional strength provided by a resolute adherence to the original plan would have enabled Kluck, Bulow, and Hausen to gain a decision.

The Battle of the Marne proper was a great strategic victory for the Allies. It turned back the invader and eventually proved to be the turning point of the war. But it was not a great tactical victory. The German troops were not demoralized, as they soon demonstrated. Only about 15,000 German prisoners were taken.

Losses on both sides during the constant and heavy fighting were huge. By the end of 1914 the French had lost 380,000 killed and 600,000 wounded, prisoners, and missing in action; the Germans, because of their better training in defense, suffered to a slightly smaller extent.

See also separate articles on the major battle sites; biographies of the leading generals; ARMY—World War I; FORTIFICATIONS; TACTICS.

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## 6. Western Front: 1915-1917—Stalemate

The war in 1914 had been open fighting insofar as that term can be applied to the western front before March 1918, and its fluctuations had covered great distances. Only at the end of the year had it become trench warfare rather than warfare waged from scrapings in the ground where the forces on either side had halted. Now this state of affairs was to be changed, though it was not until 1916 that defenses were perfected, above all in the famous line named after Field Marshal Paul von Hindenburg, to which he withdrew from the battlefield of the Somme. Even the trenches of 1915, however, altered the whole character of the war, especially in winter.

### OPERATIONS IN 1915

**British Expansion.**—At the opening of 1915 the British Expeditionary Force (BEF) had been

expanded from the original 6 divisions to a total of only 10, but in the course of that year its strength was raised to 37 divisions. While these included 2 Canadian divisions, the forces of Australia and New Zealand had been sent to Africa to oppose the Turks in Egypt. In South Africa, Gen. Louis Botha had to suppress a brief but painful revolt before he could fight the Germans in German Southwest Africa. The strength of the French on their own soil was 107 divisions, and that of the Germans 94. The majority of the remaining 65 German divisions were in Russia. Thus the main burden of the war in the west was being carried by France, and Britain, as the junior partner, was not able to make her voice heard in strategic matters.

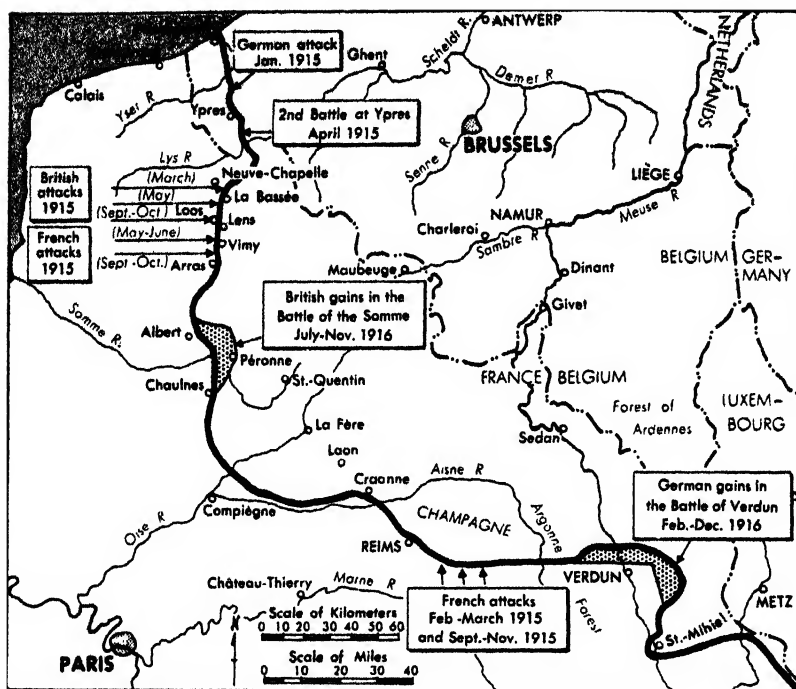
Reorganization of British arms production began on June 9 with the formation of a Ministry of Munitions, of which David Lloyd George was the first head. His vigor and persuasiveness in office coincided with a great improvement in organization and output, for which he was accorded the credit by popular opinion. While his work was undoubtedly invaluable, the foundations had been well laid by the master general of the ordnance at the War Office. Of the guns issued to the army, 1,638 were from Woolwich Arsenal, 1,406 from the United States, and 25,512 from private armament firms. Of 55,000 aircraft, 1,502 came from Royal Aircraft Establishment factories.

**German Plans.**—The extremely able chief of the German General Staff, Gen. Erich von Falkenhayn, decided to make the east the principal theater of war, buttress the Austrians there, and administer to the Russians a defeat which, if it did not remove them entirely from the war (he did not believe this was possible) would render them innocuous for a long time to come. This policy accounts for the shift of German forces eastward and for the fact that Falkenhayn himself moved to proximity with the Austrian High Command. It was all the more essential that he do so because he found it necessary to keep Gen. Erich F. W. Ludendorff, Hindenburg's chief of staff, and Lt. Col. (later Maj. Gen.) Max Hoffmann, his director of military operations, under observation. These two generals intrigued against him and urged Hindenburg to oppose him, and it was only the implacable will of Falkenhayn and the loyalty with which Emperor William II supported him that enabled him to prevail.

**Battle of Neuve-Chapelle.**—The northern fringe of the Forest of Ardenne lies about 90 miles east of Arras, and the southern fringe about 25 miles north of Verdun. The Germans could avail themselves of only one first-class rail line south of the forest, and those lines which passed through it were inadequate for the supply of their southern front. The main burden was therefore borne by the fine railway system north of the Ardenne, and most of these lines passed through the bottleneck of Liège, between the forest and the salient formed by Limburg Province of the neutral Netherlands.

For his next offensive north of Arras to capture Vimy Ridge, Marshal Joseph Joffre had called on the British to relieve the two French corps still in the salient formed at the First Battle of Ypres (Ieper) in 1914. Field Marshal Sir John French (later 1st Earl of Ypres) believed that after the relief he would be unable to afford any adequate assistance to the Artois offensive of his allies, and his solution of the problem was





**OPERATIONS ON THE WESTERN FRONT, 1915 AND 1916.** During 1915 the Germans concentrated their efforts against Russia while defending themselves on the western front. The Allies made a series of limited attacks, as shown, but without success. At the Second Battle of Ypres the Germans introduced poison (chlorine) gas to modern warfare. By the end of the year the line had not changed more than three miles at any point. In 1916 the Germans launched the bloody battle of attrition at Verdun, and the Allies undertook their equally costly offensive on the Somme.

therefore to attack before the relief. His First Army commander, Gen. Sir Douglas Haig (later 1st Earl Haig), with his brilliant staff officer, Brig. Gen. John Edmond Cough, made excellent preparations for the attack.

The assault on Neuve-Chapelle, which was launched on March 10, won complete surprise, opening a gap in the enemy's front. The Germans were unable to launch a counterattack, and such reserves as reached the scene (four battalions from four different regiments) were entirely engaged in efforts to patch holes in the line. On the following day, however, British progress had scarcely begun when the Germans, who in the course of the night had assembled 16,000 men for the purpose, launched a belated counterattack. Only at a few points did it recover any ground, but it achieved its ends by bringing the British advance to a halt, and the battle ended on March 13.

**Second Battle of Ypres.**—Falkenhayn was now tempted to make use of his "secret weapon," poison gas (q.v.). At 5 P.M. on April 22, after a fierce bombardment, Algerian *tirailleurs* were seen in headlong flight toward Ypres, some pointing to their mouths and croaking the word *gaz*. The commander of the British Second Army, Gen. Sir Horace Lockwood Smith-Dorrien, issued orders for the re-establishment of the front, but the first troops available consisted only of the reserve Canadian brigade. Though a second gas attack on April 24 inflicted heavy casualties on the Canadians, they succeeded in halting the Germans.

On April 27, Smith-Dorrien decided that the time had come for a voluntary withdrawal to the outskirts of Ypres. When the order reached headquarters, French told him to turn over his command to Lt. Gen. Sir Herbert C. O. Plumer (later 1st Viscount Plumer). The latter issued precisely the same orders as had Smith-Dorrien, however, and this time French accepted them. The

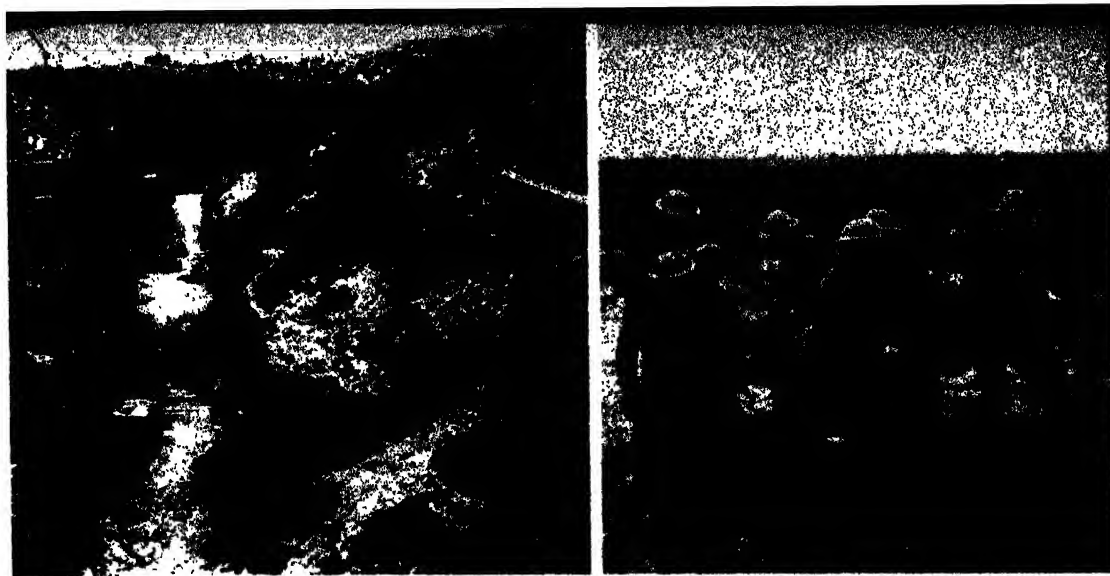
withdrawal began on May 1, and the battle came to an end after a new German attack on May 24-25. British losses at Ypres amounted to 60,000, or almost twice the German total of 35,000. For the next two years the burden of holding the reduced Ypres salient became almost intolerable.

**Second Battle of Artois.**—On May 9, the French launched their long-planned attack in Artois. Their troops were their best and were inspired by traditional French élan. Their optimism was justified at the start, when they secured a foothold on the crest of Vimy Ridge, but this was lost, and the battle ended in a deadlock on June 18. French losses totaled 100,000, and those of the Germans 75,000.

**Autumn Offensives.**—A series of offensives in the autumn of 1915 fared little better. One in Champagne (which became known as the Second Battle of Champagne) was postponed until September 25 because Gen. Victor L. L. d'Urbal in Artois estimated that his preparations could not be completed earlier. The Second Army of Gen. (later Marshal) Philippe Pétain and the Fourth Army of Gen. Fernand L. A. M. de Langle de Cary broke the German lines, but Falkenhayn's perspicacity and his immediate arrival on the scene stopped the deep withdrawal contemplated by his subordinates and restored the front. The battle ended on November 6. The Artois offensive (known as the Third Battle of Artois), which lasted from September 25 to October 15, was even less successful, as was that portion of it fought by the British at Loos.

#### OPERATIONS IN 1916

**Battle of Verdun.**—The aim of Falkenhayn in 1916 was to lower French morale, which he suspected had already been weakened by defeatist propaganda. He chose for the front of attack the region of Verdun because he was confident that the French would be induced by the prestige of its name to fight for it to the last man, and



Imperial War Museum, London

Left: British at Ovillers in July 1916, during Battle of the Somme. Right: British stretcher bearers in deep mud.

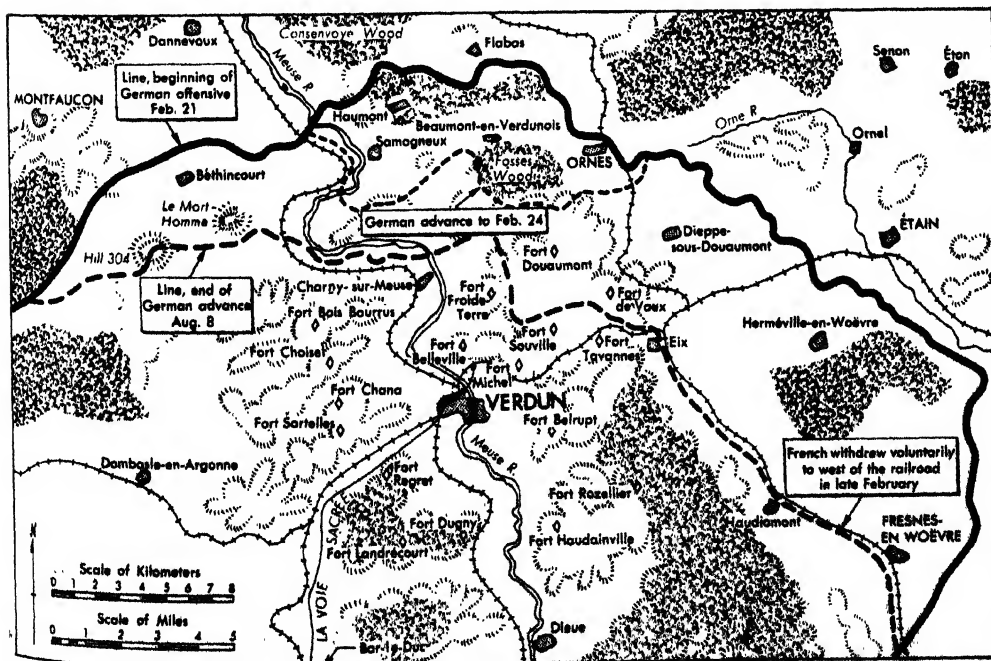
his object was to bleed France white. The second reason was the corollary of the first: Verdun was a self-contained slaughterhouse, the flanks of which need not be extended. The attack was to be made by German Crown Prince William, commander of the Fifth Army.

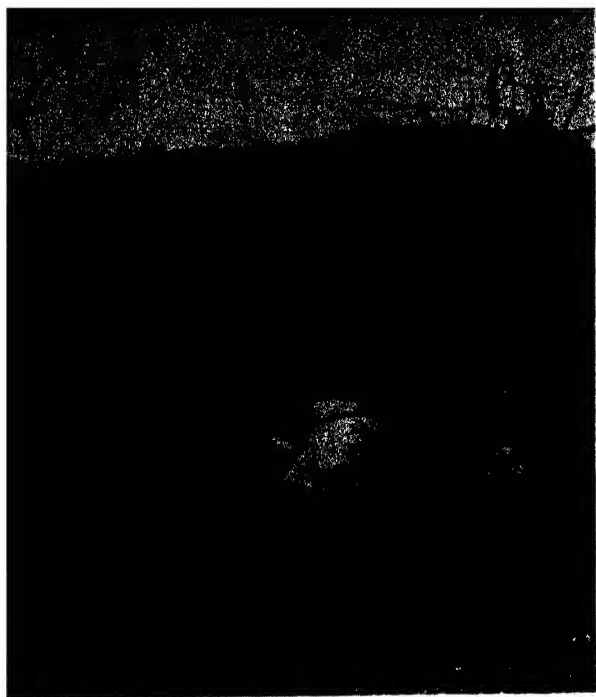
The French commander at Verdun was General Pétain. He had no responsibility for any lack of preparedness, for he had been summoned by Joffre only four days after the launching of the offensive on February 21, but his calm and methodical nature was ideally suited to making the best use of the assets and remedying the defi-

ciencies, the chief of which was the lack of adequate railways. The main artery was a narrow secondary road from Bar-le-Duc, 40 miles to the south, which held out against constant German shelling because of widening, first-class organization, and incessant repairs. The French came to call it *la Voie Sacrée* (the Sacred Road).

Both sides fought with equal bravery, and the Germans with extraordinary tactical skill. The manner in which they were able to cancel assaults in a few minutes when a company commander on patrol noted that the French were particularly on the alert was astounding; they were equally

**BATTLE OF VERDUN (Feb. 21-Dec. 18, 1916).** Knowing that the French would defend Verdun to the last, the Germans attacked with a view to inflicting heavy casualties and thus alter the manpower balance on the western front. In heavy and vicious fighting the Germans made the moderate gains shown. In the period October-December, the French counterattacked, recaptured Fort Douaumont and Fort de Vaux, and advanced almost to Ornes. Fighting stopped on December 18, after the French had suffered about 550,000 casualties, and the Germans 450,000.





U.S. War Dept. General Staff

Two German soldiers lay out lead piping in preparation for a poison gas attack in August 1917.

quick and clever in shifting the weight of an attack from a strong to a weak point of resistance, and their handling of their artillery was masterly. The French had no opportunities for such nicety of tactics because they were limited to straight counterattacks, but two commanders earned exceptional reputations. These were Gen. Robert Georges Nivelle, who came in as a corps commander and succeeded Pétain in command of the Second Army; and Maj. Gen. (later Gen.) Charles Mangin, who commanded the 5th Division and somewhat later was promoted to the command of a corps. The French were, however, plagued by a series of panics, which involved unnecessary withdrawals. These did not include the loss of Fort Douaumont on February 25, because it was ungarrisoned and was taken by a single German company. Here, too, the situation changed speedily. On April 10, a German assault south of the fort was shot to fragments, and as a consequence the best German corps commander, Gen. Bruno von Mudra, was replaced by Gen. Ewald von Lochow. The French artillery was also brilliant. The German giant howitzers in very many cases were destroyed, and throughout the battle they were harried mercilessly by the French long 155-mm. guns.

In the final phase of the Verdun offensive the Germans slowed down still further, but they gained one more outstanding success on the right bank of the Meuse River. Pétain had realized the falsity of the prewar doctrine that the forts of Verdun should be dismantled and their guns used in the field. He had done all that lay in his power to remedy the situation by providing the forts with permanent garrisons of about 300 men each. On the German side the crown prince's resolute chief of staff, Gen. Konstantin Schmidt von Knobelsdorf, obtained permission to attempt the capture of Fort de Vaux and, if successful there, of Forts Souville and Tavannes

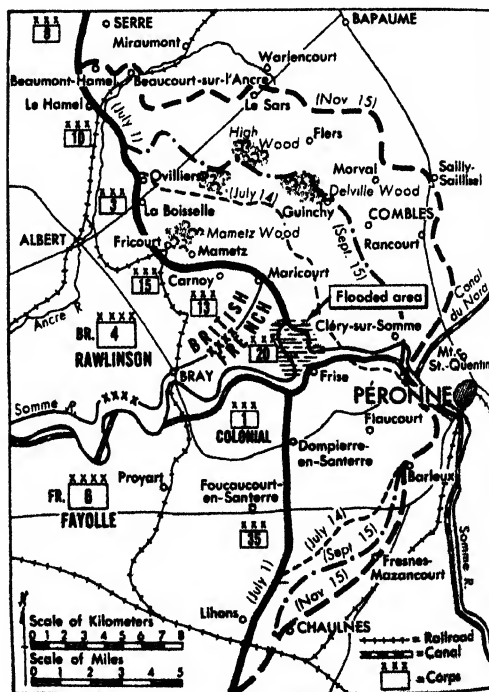
as well. The defense of Vaux by Maj. Sylvain Eugène Raynal was heroic. After the fort had been completely surrounded, he fought on desperately, repulsing attack after attack and surrendering only when the water supply gave out on June 7.

For the attack on Souville and Tavannes on June 21, the Germans used the lethal green-cross gas shell but were completely routed. Although the fighting continued until July 11, this was the real end of the offensive. Its only achievement had been to reduce the French contribution on the Somme. French casualties totaled 315,000; German casualties, 280,000.

Later, on October 24 and December 15, Nivelle and Mangin launched two successful attacks at Verdun. These won back a large proportion of the ground lost and almost all that counted.

**Battle of the Somme.**—Once more General Haig had the experience of fighting a battle in the wrong place, since the Somme Valley was barren of major strategic objectives. The terrain was poorly watered, and the population was sparse. The toil of excavating dugouts in the chalk, which had begun early in the year, was immense.

The assault was launched on July 1 under the command of Gen. Émile Fayolle and Gen. Sir Henry Seymour Rawlinson (later 1st Baron Rawlinson).



**BATTLE OF THE SOMME (July 1–Nov. 18, 1916).** In conformity with their over-all strategic plan for 1916—and to relieve the pressure on Verdun—the Allies launched an offensive astride the Somme River against what were perhaps the strongest German defenses on the western front. Immense preparations were made for the attack, including a seven-day bombardment. The British Fourth Army, making the main attack, advanced in dense formations and suffered many casualties. The Allies gained some territory but no particular strategic or tactical advantage. The battle developed into an even greater struggle of attrition than Verdun. The Germans lost 450,000 men; the British, 420,000; and the French, 195,000. In this battle, the British introduced the tank to the battlefield.

inson), who were opposed by Gen. Fritz von Below. Fayolle could muster only five divisions in the first line astride the Somme, but he was much stronger than the British in heavy artillery. His success was complete. The British 13th Corps on the French left did equally well, but this was the end of success. The British suffered overwhelming defeat and great casualties, the loss for that day amounting to 57,450. There was nothing Haig could do but confine the attack to the area on which ground had been won. He formed a new army, the Fifth, under Lt. Gen. Sir Hubert de la Poer Gough, for a holding operation on the Ancre River. The Germans did likewise, putting Gen. Max von Gallwitz in command of a new army south of the Somme.

The fortunes of the battle fluctuated in succeeding weeks. Haig had adopted the policy of attrition as completely as Joffre had, while Gen. (later Marshal) Ferdinand Foch, the army group commander, had never believed in the Battle of the Somme except as a means of relieving the pressure on Verdun. On August 29, Falkenhayn was dismissed by the emperor. Hindenburg, his successor as chief of staff, came west with General Ludendorff.

On September 15, the British launched a general attack on a 10-mile front. For the first time they used 36 units of the weapon of the future, the tank, with considerable success. Haig has been criticized for disclosing the new weapon prematurely and thereby losing the element of surprise, but this verdict is of doubtful validity in view of the fact that he had available almost precisely the same number of tanks at Arras in the following spring. What is indisputable is the widespread impression that both Haig and Joffre wasted lives on the Somme. Joffre was regarded in France as being immersed so deeply in petty problems, harassed so greatly by the task of placating politicians, and at the same time presiding over what amounted to a ministry of war at Chantilly, as to be out of date. Premier Aristide Briand made every effort to save him by bringing in a new fighting subordinate and leaving Joffre in general control. It could not be done. The part played by the new man was honorable, but Nivelle was destined to the supreme command. In December, Joffre and Foch were both retired.

Meanwhile, the Battle of the Somme ended on November 18. The casualty figures, which have been much disputed, were as follows: German, 650,000; British, 420,000; and French, 195,000. In all, 95 German divisions (including those which entered the battle more than once), 55 British divisions, and 20 French divisions were engaged.

#### OPERATIONS IN 1917

The year 1917 opened with several promising peace proposals. First came that of President Woodrow Wilson. On Dec. 18, 1916, he had addressed circular notes to the American diplomatic representatives accredited to the belligerent governments. These were not offers of mediation but requests for statements of terms; in fact, the governments of the Central Powers did not venture to disclose their terms, while those of the Allies sent Wilson wholly unacceptable terms that included the division of the Austro-Hungarian Empire. On Jan. 22, 1917, Wilson addressed to the Senate a speech that called on the belligerents to accept "a peace without victory," and

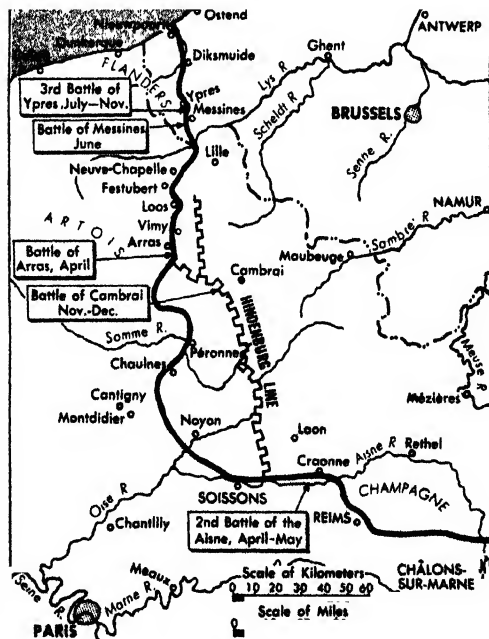


U.S. War Dept. General Staff

Flamethrower sets battlefield afire as Germans defend their lines against an approaching British tank.

reached its apogee in its delineation of the American people as peacemakers. Only 10 weeks later, however, the president led the United States to war. This change of view was due to the German decision, announced on January 31, to reintroduce unrestricted submarine warfare. Another peace appeal, that of Pope Benedict XV, also failed, as did that of the new Austrian emperor, Charles I, made through the medium of his brother-in-law, Prince Sixte (Sixtus) of Bourbon.

The British people hoped that the aid of the United States would be instant and overwhelmingly strong, but the government and the fight-



**ALLIED OFFENSIVES IN 1917.** The principal Allied offensive of 1917 was to be a great French attack on the Aisne, preceded by a British attack in the Arras area to draw German reserves away from the river. The Germans, apprised of the plan, withdrew voluntarily to the Hindenburg Line. The French attack on the Aisne was repulsed with such enormous losses as to cause widespread mutiny in the French Army. Primarily to occupy the Germans while the shattered morale and confidence of the French were being rebuilt, the British launched successive offensives at Messines, Ypres, and Cambrai. These attacks made moderate gains and succeeded in preventing a German offensive against the disorganized and weakened French.

ing forces were well aware that this was impossible. The one powerful and immediate military aid that the United States could afford was naval. By June 5, 34 American destroyers were based on Queenstown (now Cobh), from which they joined in the antisubmarine warfare in the Atlantic.

By far the most important event of the year, however, was the revolution in Russia. The Petrograd Soviet of Workers' and Soldiers' Deputies, formed on March 12, compelled Czar Nicholas II to abdicate. He was replaced by a provisional government in which Alexander Kerenski became minister of war and, later, prime minister. Kerenski was determined to maintain the war against the Germans, Austrians, and Turks. He found Gen. Aleksei Brusilov, the best of the Russian generals, ready to become commander in chief and confided to him all the most reliable troops, especially the Siberian. The offensive, which was launched on July 1, began with a heartening success, but the process of demoralization had gone too far, and the bulk of the troops were soon streaming homeward. The end came with the Bolshevik Revolution of November 6-7, and the accession of Lenin and Leon Trotsky to power. Armistice talks with the Central Powers opened at Brest-Litovsk (now Brest) on December 3. Russia had been driven from the war in the same year that the United States entered it, but Russia was armed and, unfortunately for the Allies, the United States was not.

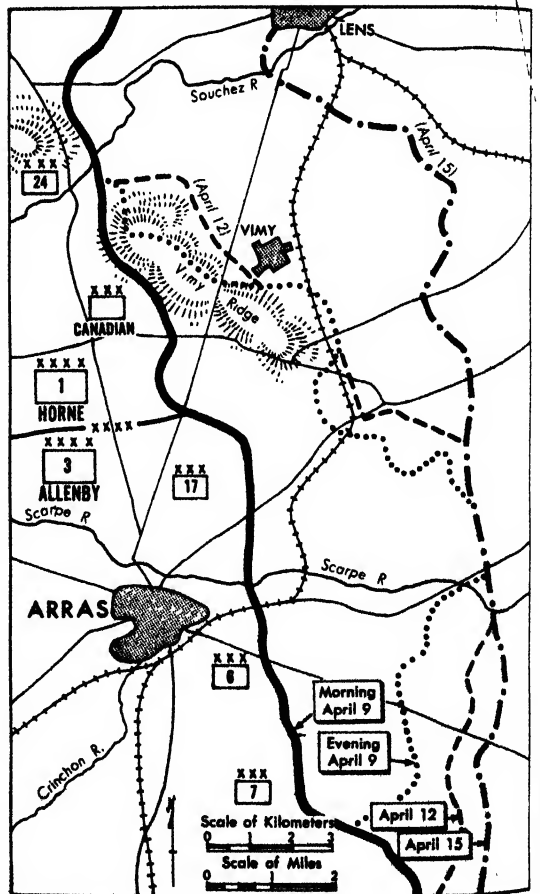
**Nivelle's Offensive.**—Meanwhile, Nivelle had put into operation plans differing vastly from Joffre's cautious program. His theory was that what could be and had been done on a small scale could be done on the greatest scale yet envisaged in the war. The chief component of his tactics was lightning speed, but his gunner's eye showed him exactly how far he must go in the first rush after his colossal bombardment was over: the line of the enemy's field batteries. The second component was surprise. Such reserves as the enemy could bring into the breach were to be destroyed, after which the huge French reserve would push forward.

There must, however, be a single great diversionary attack, and this was allotted to the British. Through a secret agreement with the French government, made at Calais without the knowledge of his own commander in chief, the new prime minister, Lloyd George, had arranged to place Haig under Nivelle's orders. Nivelle interpreted this as making Haig no more than an adjutant and quartermaster general, looking after his troops and serving as an intermediary between the British government and the French commander. This arrangement was subsequently modified so that Haig retained absolute command of the British Army and had the right to appeal against French orders if he considered that they placed him in peril, but he remained suspicious.

Everything else that could well go wrong did so. The retreat of the Germans to the strong defensive position of the Hindenburg Line, which was completed by April, was disregarded by Nivelle, although it placed at their disposal large reserves. Carelessness which involved the German capture of two vital documents in trench raids revealed the exact boundaries of the attack between Reims and Soissons. The army group commander, Gen. Joseph Alfred Micheler, who had been chosen by Nivelle because Pétain disapproved of the plan, finally

disapproved of it just as heartily.

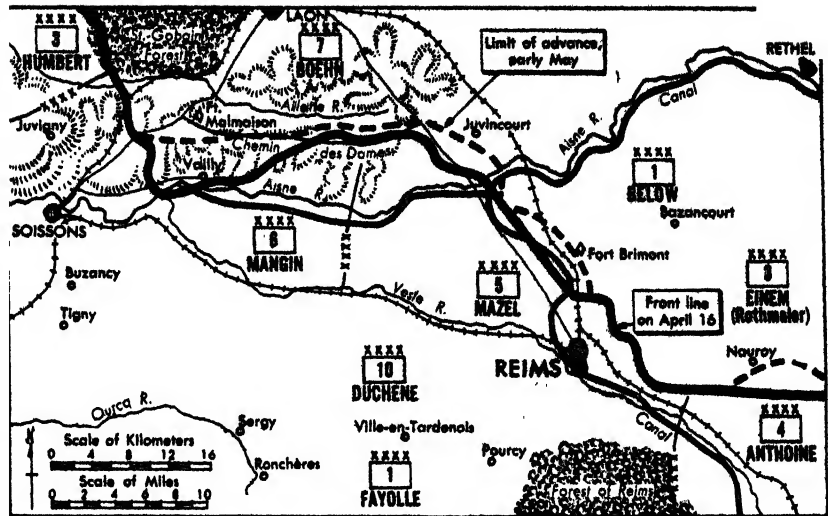
Nevertheless, the attack, in what became known as the Second Battle of the Aisne, began on a grand scale on April 16. The troops of Generals Mangin and Olivier C. A. A. Mazel dashed forward with gallantry and confidence, but German machine guns soon called at least a partial halt to the advance. This had been a commonplace in previous battles, but it was fatal to the new theories of Nivelle. Moreover, many of the 200 French tanks were destroyed. On the following day, Nivelle achieved a substantial success when the enemy was driven from the Fort Malmaison salient for a gain of two and one-half miles, and though this could be described as a voluntary withdrawal, it involved the loss of a great quantity of German artillery. Finally, however, the continuation of the offensive was postponed by the French cabinet until May, when it failed again. Meanwhile, on April 29, Pétain was appointed chief of the General Staff, and on May 15 he superseded Nivelle, being himself replaced by Foch, who came out of retirement to serve as chief of staff.



**BATTLE OF ARRAS (April 9–May 3, 1917).** The German withdrawal to the Hindenburg Line had invalidated the Allied plan for their 1917 offensive; nevertheless, Gen. Robert Georges Nivelle, the French commander, persisted in going ahead with the attack on the Aisne. The plan provided for an initial British offensive at Arras to draw German reserves away from the Aisne. This offensive had great initial success, but was soon halted by stiffening resistance. The only important gain was the capture of Vimy Ridge by the Canadian Corps, which provided a firm northern anchor for the British in the first great German drive of 1918.



**SECOND BATTLE OF THE AISNE** (April 16–May 9, 1917). In the area chosen by Nivelle for his great offensive the French armies would have to attack across three steep ridges, including the formidable Chemin des Dames, cut by ravines covered by woods and heavy undergrowth. Since Nivelle had publicized his coming offensive the Germans had had ample time to convert these natural barriers into a veritable fortress. The offensive was poorly organized and fell into confusion from the start, and by nightfall of the first day it was evident that the attack was a failure. Nonetheless, Nivelle persisted in ordering successive futile and costly attacks. By early May, widespread mutiny had broken out in the French armies.



There has been much dispute about French losses in the offensive, Nivelle's bitterest opponents alleging that they were actually twice as large as the figures announced. The probability, however, is that they were not much higher than those listed in the French official history, or 96,000. The Germans lost 163,000 men. Their gains and the French losses were augmented by the destruction of French morale in widespread mutinies. The number of verdicts of guilty was 23,385, but only 55 men were shot. The French Army was out of action for a considerable time.

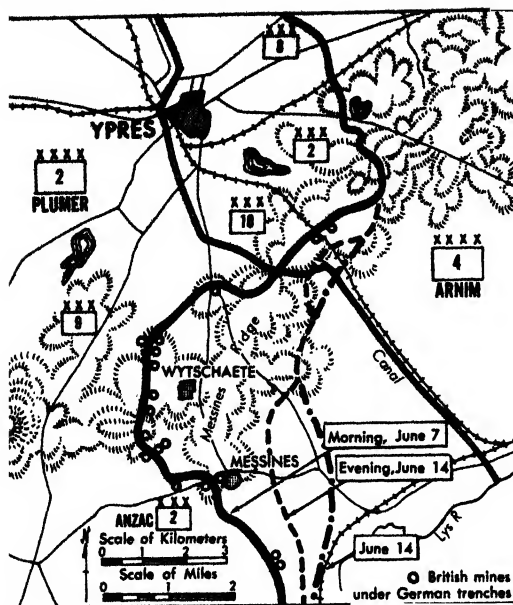
**Battle of Arras.**—Haig began 1917 as a field marshal, secure in the confidence of George V, who wrote after the Calais conference: "The King begs you to dismiss from your mind any idea of resignation. Such a course would be, in His Majesty's opinion, disastrous to his Army and to the hopes of success in the coming struggle." The offensive to which he was pledged in support of Nivelle extended from approximately eight miles south of Arras to seven miles north of it, and was to be carried out by the Third Army of Gen. Sir Edmund Allenby (later 1st Viscount Allenby) on the right and the First Army of Gen. Sir Henry Sinclair Horne (later 1st Baron Horne) on the left. The whole of the German front was under the command of Gen. Baron Ludwig von Falkenhausen. The initial attack was to be made by 14 divisions, but for the first time the British were not undergunned and had at their disposal 2,800 pieces. The Germans had 6 divisions in the line, but they also were in the novel situation of possessing abundant reserves—another 6 divisions.

The attack began successfully on April 9, in squally, snowy weather, even though the tanks were an almost complete failure, all of them being either ditched before they went into action or speedily maimed when they did so. The advance immediately north of the Scarpe River was the deepest made by any belligerent since trench warfare had frozen the western front. Here Lt. Gen. Sir Charles Fergusson's corps breached the German third line, captured the village of Fampoux, and covered a distance of three and one-half miles. Horne's army prospered as greatly as Allenby's did, but the Canadian Corps of 4 divisions, which bore the main

burden in the assault, had not far to go on the muddiest part of the front to the crest of Vimy Ridge. The ridge was not completely secured by nightfall, but little was left for the following day.

That day provided a rude shock. Allenby's simple telegraphed order overnight to pursue a beaten army was issued under a misapprehension. The army was indeed beaten, but there was another of equal strength in the rear. Falkenhausen had disobeyed orders so that he could keep his reserves out of range, and they were on the average 15 miles farther east than they ought to have been. Now they were ready to fight, while the original British divisions were exhausted. Nothing serious could be attempted until April 23, when in a two days' battle the British outfought the enemy but made small progress. The last phase of the battle was the single day of May 3, when Haig permitted the attack to proceed solely in the hope of aiding Nivelle to keep the French fighting. Intervention by Gough's Fifth Army on the right at Bullecourt led to the terrific slogging described in detail in the writer's official work, *Military Operations: France and Belgium, 1917*. (vol. 1, London 1940).

**Battle of Messines.**—Haig now turned to Flanders and the operation which had been in his mind since February, the clearance of the Flemish coast, the only place where a flank could be found and rolled up. He was already under heavy pressure from Pétain to keep the Germans off the French, and from the British Admiralty to root out the submarines based on Bruges and making their sorties from Ostend (Oostende) and Zeebrugge. The first part of the program was the capture of the Messines (Mesen) Ridge, the steepest approach; after this had been accomplished, the main advance was to be made toward Roeselare (Roulers) and Thourout (now Torhout). The most remarkable feature of the battle was a great chain of mines, the earliest of which had been begun two years before, which had been driven into the bowels of the ridge, two of the galleries being 2,000 yards long. At zero hour, 3:10 A.M. on June 7, the mines were exploded with tremendous effect. The nine divisions of Plumer's Second Army



**BATTLE OF MESSINES (June 7-8, 1917).** With the French armies almost prostrate on the Aisne, the main weight of the war fell on the British. At the same time, the collapse of Russia made it necessary to strike a vital blow on the western front before German strength could be transferred from the eastern front. The British chose the Ypres area, where a breakthrough would outflank the entire German defensive system; but first the Messines Ridge, which gave the Germans perfect observation over the British lines south of Ypres, had to be cleared. In a brilliant, well-planned, and perfectly executed operation (in which hundreds of tons of mines were placed under the German position) the ridge was quickly captured.

swept through to the crest of the ridge. Crown Prince Rupert of Bavaria immediately ordered all troops to fall back behind the Ypres-Comines (Komen) Canal.

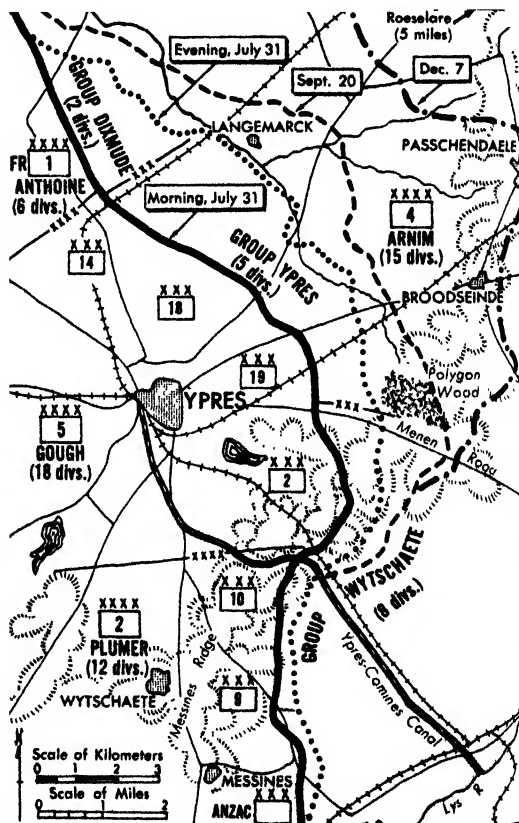
For the main battle, Haig had brought up Gough and the headquarters of the Fifth Army to divide the command with Plumer. Feeling that the moment was appropriate for displaying greater dash than was likely to come from this cautious veteran, he allotted the main role to Gough, though Plumer had not left the Ypres salient since he superseded Smith-Dorrien and knew it well. The result was a delay caused by the adaptation of Plumer's methods to Gough's, and this was accentuated by a slow concentration of the small, elite First French Army commanded by Maj. Gen. François Paul Anthoine.

**Third Battle of Ypres.**—The interval since the assault on the Messines Ridge had been one of cloudless hot weather, and this continued on July 31, when the Third Battle of Ypres began. The attack did well and, even after Gough's left had been robbed of a considerable amount of ground by fierce and gallant counterattacks, retained a maximum advance of two miles. That evening the weather broke. The Battle of Langemarck (now Langemark) was fought on a dry day on August 16, but remission for a day or two no longer counted. The shell holes were filled to the brim with water. Every round of ammunition had to be carried over the final stage on pack saddles, and many mules and a considerable number of men were drowned. Haig had to reverse once more the roles of his two army commanders, and the sideslipping required for

the purpose wasted still more time.

Plumer had determined to act with extreme deliberation, securing the Ypres Ridge with divisions closed down to 1,000-yard frontages, often with two of the three brigades in support and reserve, tremendous barrages, and very limited objectives, in three separate thrusts. The skilled and devoted work of the Royal Engineers in constructing plank roads and laying duckboards enabled him to assault in maximum strength, and he was also helped by miraculous good fortune. The first two battles, Menin (Menin) Road Ridge (September 20-25) and Polygon Wood (September 26-October 3), were actually fought in clouds of blinding dust, and though the rain had recommenced on October 3 before the third battle, Broodseinde, the ground was still in excellent condition. This time, however, it had to be taken for granted that the weather had broken for good, and it was now autumn.

The last phase of the battle (October 26-November 6) resulted in the name of the village of Passchendaele (now Passendale), which covers a single final incident, having been ex-



**THIRD BATTLE OF YPRES (also called Battle of Passchendaele; July 31-Nov. 6, 1917).** With the Messines Ridge cleared, the British launched their Ypres attack. A 10-day preliminary bombardment churned up the sticky clay, thereby slowing the advance. Nevertheless, the first day's objectives were captured despite German counterattacks. Then a 14-day heavy rain begged down guns and transportation. Tactical success was no longer possible, but, with the French armies demoralized, continued British pressure on the Germans was essential to prevent disaster. Flooding along in the mud and subjected to mustard gas, which was added to the horrors of the battlefield by the Germans, the British finally captured Passchendaele on November 6, and the battle ended.

panded in popular parlance to cover the whole Third Battle of Ypres. The losses associated with it also led to bitter criticism of Haig. The British loss for the entire battle was 240,000, and the German loss almost precisely the same; 37,000 prisoners were taken.

**French Victories.**—Pétain was eager to contribute all he could, both to aid the British offensive and to test the recovery of the French Army and encourage its self-confidence. The first of these experiments was the victorious blow struck by Gen. Marie Louis Adolphe Guillaumat and his Second Army on August 20 near Verdun. It was an invaluable effort, but the anxiety it created in German minds was brief, though Ludendorff for the next month or so expected the foe to try again. The second and more famous episode was delayed until the end of the main battle on October 23 and was carried out by the Tenth Army, commanded by Gen. Paul André Marie Maistre. By November 1, the attack had recaptured Fort Malmaison and secured 12,000 prisoners.

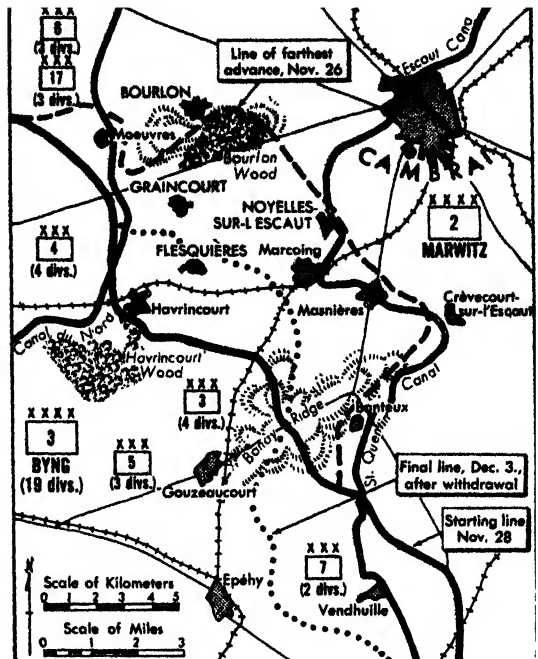
**Battle of Cambrai.**—As the year 1917 drew to its end, Haig realized that at most one more offensive would be possible before he and the French faced the full flood of the German divisions set free by the Russo-German armistice. By the end of October, he was doubtful whether even that much would be possible. Between October 24 and November 11, Austro-German forces won a brilliant victory over the Italians in the Battle of Caporetto (now Kobarid). The rout ended on the Piave River after 11 Franco-British divisions had been sent to Italy from the western front, but before they had been in action.

Meanwhile, Haig's problem was that he was still unsure of how many troops he would have to send to Italy (actually, the British contingent was reduced to 5 divisions, whereas the French sent the original quota of 6). This anxiety was, however, mild by comparison with his satisfaction that tanks were at last to be used as their creators had foreseen, and that he could allot the Third Army of Gen. Sir Julian H. G. Byng (later 1st Viscount Byng) 324 tanks, as against the 48 in action at Arras. Moreover, owing to new artillery methods, especially sound ranging and flash spotting, every German battery could be pin-pointed, a preliminary bombardment could be dispensed with, and complete surprise could be achieved for the first time.

At 6:20 A.M. on November 20, the fire and the advance of the tanks began simultaneously. By evening the advance exceeded three miles, and it might have been far greater but for the one calamity of the battle at Flesquières, where a single German field battery knocked out tank after tank as they breasted the rise, and the supporting infantry could not force a way through the wire of the Hindenburg Line while it remained uncut. The battle now resolved itself into a fight for the height surmounted by Bourlon Wood, which was taken and retaken.

Ludendorff saw exactly what was required. He massed his reinforcements on the flanks of the bulge between Banteux and Moeuvres and directed Gen. Georg von der Marwitz, commanding the Second Army, to eliminate it by convergent thrusts. Marwitz struck at 8:30 A.M. on November 30, after a bombardment maintained all night and on the southern flank won a great victory. The German infantry had never

fought with greater enthusiasm or tactical skill. Disdaining the heights which commanded the valleys, it made use of these to paralyze the defense. The attack not only smashed the British array on the new front, but captured the original position farther south on a frontage of three miles. The Guards Division recovered Gouzeaucourt, however, and brought the enemy's advance to a halt.



**BATTLE OF CAMBRAI (Nov. 20-Dec. 3, 1917).** As a possible solution to the breaking of the stabilized front, the British launched a massed attack of almost 500 tanks at dawn on November 20. Cavalry followed closely to exploit the hoped-for breakthrough. The attack gained spectacular initial successes, but by nightfall the tanks and cavalry had become stalled along the difficult St. Quentin Canal. For the next few days bitter fighting took place for Bourlon Wood; by November 26, the advance had progressed only to the line shown. On November 30, an overwhelming German counterattack drove the British steadily back. By December 3, they had stabilized their lines, retaining some ground gained in the center, but losing an equal amount of their original holdings to the south. This first massed tank attack had failed; but it indicated great promise for the future.

The same tactics were employed on the northern flank, but on more open ground with better observation they did not meet the demands of the situation. The guns were firing over open sights, shooting the successive waves to fragments, and when the accompanying batteries strove to unlimber, they laid out the horses so that the guns were thenceforth stationary. Prince Rupert and Marwitz called off the battle on the night of December 1. Between December 4 and 7, Haig had to yield a few more of his gains in order to obtain a defensible front based on the Hindenburg Line. His losses totaled 43,000 men, including 6,000 prisoners taken on the first day of the counteroffensive; those of the Germans, 41,000 men, including 11,000 prisoners. The British public, which had listened to the premature ringing of church bells, was bitterly disappointed by the reversal of fortunes and staggered by the loss of guns:

158, as contrasted with 138 taken from the Germans.

The most interesting feature of Cambrai was its significance for the future. The tactics and strategy of World War II were first developed in this battle, and the victories of 1918, beginning with the reduction of the Amiens salient on August 8–September 3, depended on it to an equal extent.

See also section 15. *Diplomatic History of the War*; separate articles on the major battle sites; biographies of the leading statesmen and generals.

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## 7. Western Front: 1918—The Year of Decision

At the beginning of 1918 the Allied situation was critical. Though Gen. (later Marshal) Philippe Pétain had succeeded in quelling the mutinies that followed the disastrous attacks of Gen. Robert Georges Nivelle on the Aisne River in April 1917, French morale had not been completely restored. Three years of bitter offensive fighting had so depleted France's manpower that much of her infantry now consisted of men too young or too old to be the most effective fighters. The British personnel problem was also acute. Infantry units were composed mostly of replacements, but their morale was much better than that of the French, and they could be depended on to fight. Prime Minister David Lloyd George, however, fearing that Field Marshal Sir Douglas Haig (later 1st Earl Haig) would repeat his costly and futile attacks of 1917, refused to send large reinforcements to the Continent. Haig was forced to reduce the battalions in his divisions from 12 to 9, thereby generating resentment among the officers and men whose units were disbanded.

The Italian disaster at Caporetto (now Kobarid) in October 1917 had necessitated the dispatch of 11 precious Allied divisions to bolster the faltering Italians, who even by 1918 had not fully recovered. Russia and Rumania had been knocked out of the war by the Germans, and American troops were slow in arriving. On March 1, 1918, nearly a year after she had entered the war, the United States had only 6 divisions in France; of these, 2 lacked combat experience, and the other 4 had served only in quiet sectors. The only recourse for the Allies seemed to be to hold fast on the western front until American forces arrived in sufficient strength to launch a general offensive. The French and British accordingly took up a defense in depth over most of the front (similar to the defensive system developed by the Germans in 1917) and braced to meet the German onslaught, which was sure to come. Haig and Pétain agreed to assist each other promptly in case of attack, but there was no unity of command to guide the Allied effort forcibly. The Supreme War Council, with no troops under its control, could act only as an advisory body. A plan to form a 30-division general reserve under the council's control had been vitiated by Haig's contention that he could not spare any divisions and still retain responsibility for his front.

The general situation of the Germans was little better than that of the Allies. Although submarine warfare had greatly reduced Allied shipping, it had failed to starve Great Britain or

to halt the flow of American troops across the Atlantic. Conversely, the Allied blockade, coupled with the inefficient use of the internal transportation system, was causing hunger and discontent among the German people. Germany's allies were faltering: Austria-Hungary, through popular pressure, refused to send troops to the western front, preferring to concentrate her forces against the Italians; Turkey's armies had been futilely expended in Mesopotamia and Palestine; and Bulgaria was war weary. Nevertheless, the German manpower situation was more favorable than that of the French and British, for the collapse of Russia had released sizable German forces from the eastern front. Many of these divisions, having seen little fighting for almost a year, were fresh, and their troops were eager to fight.

Gen. Erich F. W. Ludendorff, through his string of victories, keen intellect, and strong personality, had by now overshadowed Emperor William II and the successive German chancellors, and the decision as to the next major German move was his to make. A victory was needed to bolster Germany's prestige among her allies; moreover, the Americans were arriving in increasing numbers and would make their strength felt by summer. Ludendorff concluded that decisive action was mandatory on the western front in the spring of 1918, and plans were prepared accordingly. Troop transfers from the eastern front gave him a 10 percent advantage in combat personnel in the west, but he lacked reserve strength, since the reservoir of German youth had been almost drained by heavy demands in previous years. This deficiency made it imperative that the initial attack be decisive, for if its impetus were retarded, there would be little left to engage. Ludendorff, however, was confident of the effectiveness of his numerical superiority and of the success of new German offensive tactics.

Three areas were considered for the offensive: Verdun, Flanders, and the Somme. The Verdun area was rejected because of the difficult terrain and the lack of a major strategic objective. The Flanders area was the best, for a breakthrough there would lead to the channel ports, which were vital to the British on the Continent, but the wet ground in the area precluded an attack before April. While there was no critical terrain feature in the Somme area, a breakthrough to the sea would separate the French and British and would crowd the latter into a pocket in which they might later be destroyed. Thus the Somme area was chosen of necessity. Since it had been devastated in the 1916 battles, the speed of the German advance would be reduced; on the other hand, it was the most lightly held sector of the three considered. Ludendorff selected the British as his primary target because he believed that the defeat of Britain would bring a favorable peace. Moreover, he considered the French troops the more skillful (if less tenacious) in defensive operations, and the expert French artillery was much to be feared. His staff had urged two limited offensives at different points to throw the Allies off balance, but Ludendorff, experienced only in successful single crushing offensives on the eastern front, decided that he had enough troops and guns for only one major offensive. To deceive the Allies and to facilitate other attacks if these should be found desirable, however, preliminary

preparations, such as the stockpiling of ammunition, were begun at two places in Flanders: opposite the Ypres (Ieper) salient, and to the south of it. In addition, simulated preparatory bombardments were planned at other places along the front.

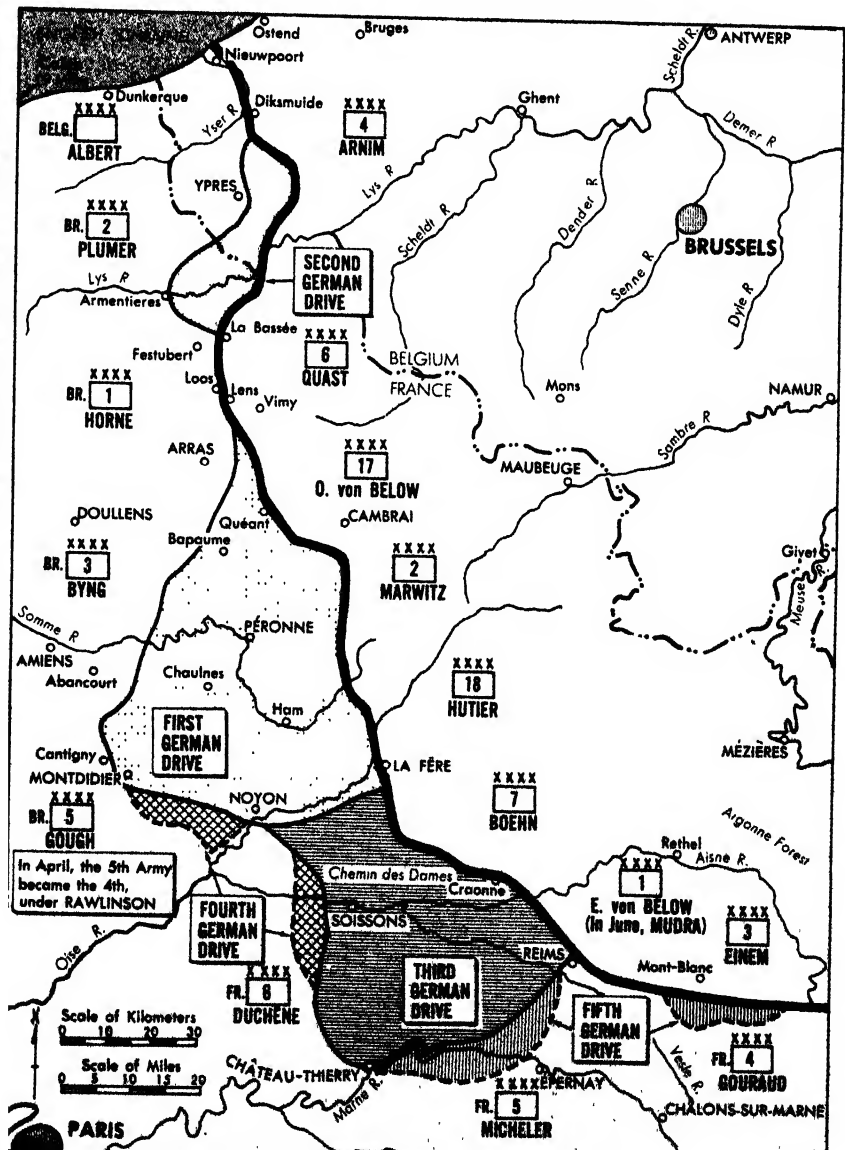
#### GERMAN DRIVES OF 1918

Though surprise was an essential element in the German scheme, Haig had developed a fair estimate of Ludendorff's plan. Pétain, however, had concluded that the attack would come in his sector, in the Reims area. The British and French each attempted to organize a deep defensive zone, but because of manpower shortages and the negligence of subordinate leaders neither zone was completed in time.

Ludendorff expected to break the deadlock on the western front by the large-scale application of the new Hutier tactics, which had been developed by Gen. Oskar von Hutier and his staff at Riga and had been tested successfully at

Caporetto. These tactics made radical changes in the employment of artillery and infantry. Instead of a lengthy bombardment designed to obliterate the defenses within a limited zone, such as the 19-day shelling in the Third Battle of Ypres in 1917, only a short preparation was fired. It included a high proportion of gas and smoke shells and was designed to put out of action for a short period the enemy gun positions, headquarters, machine guns, observation posts, and trenches. After this preliminary bombardment, the artillery began to fire a rolling barrage that started on the enemy front line and moved forward at a predetermined rate. The rate varied with the terrain and the opposition expected, but was usually one kilometer per hour. The infantry followed the rolling barrage as closely as possible. The advance of each unit was planned in great detail by higher headquarters so as to infiltrate between known hostile centers of resistance. When the barrage reached the limit of its range, full control of the various

**GERMAN DRIVES OF 1918.** (March 21–July 17, 1918). Russia's collapse enabled the Germans to gain numerical superiority on the western front. It was decided to make a supreme effort to defeat the French and British before the Americans could arrive in sufficient numbers to intervene effectively. Five separate drives were made: in March, April, May, June, and July. Two—the first and third—won spectacular tactical success, but they did not achieve a breakthrough to split the Allies and gain a strategic victory. These tremendous but unsuccessful efforts cost the Germans 800,000 casualties and seriously depressed the morale of the German troops. Exhausted, the Germans were forced to surrender the initiative to the Allies.





units reverted to the regimental and battalion commanders, and the troops advanced as fast and as far as possible in a given general direction, no objectives being specified. When strong resistance was met, leading units bypassed it and moved speedily ahead, disregarding the security of their flanks and leaving the reduction of resistance to follow-up units. Each assault battalion had its own light artillery; infantry troops were formed into small battle groups, each of which was built around the light machine gun (formerly the bulwark of defense but now considered by the Germans the principal infantry weapon in the attack).

The new tactics demanded exceptional standards of training and physical fitness, especially on the part of the infantry. The operations at Riga and Caporetto had been conducted on a moderate scale against enemies of low morale; the contemplated Somme operations were to be on a gigantic scale and would require dozens of highly effective shock divisions. These were pulled out of the line early, filled with selected men at the expense of the other divisions, and extensively trained. Since the Germans had few tanks, this weapon was to play little part in the attack, but special air units were formed to provide low-level bombing and strafing in support of the ground attack.

**First German Drive (Somme Offensive), March 21–April 4.**—The plan for the Somme offensive was simple. Three German armies were to break the British front from Arras to La Fère: the Seventeenth Army, under Gen. Otto von Below, in the north; the Second Army, under Gen. Georg von der Marwitz, in the center; and the Eighteenth Army, under Hutier, in the south. The Second and Seventeenth armies belonged to the army group commanded by Crown Prince Rupert of Bavaria; the Eighteenth Army, to that of German Crown Prince William. Ludendorff engaged these units of two army groups so that he could exert greater over-all control and ensure that the resources of both groups would be used to the maximum extent. Initially, the three

armies were to advance straight ahead on their respective fronts: the Seventeenth to Bapaume, then northward toward Arras; the Second to Péronne, then northwestward to Doullens; and the Eighteenth to the Somme River, where it would protect the south flank of the general offensive against probable French counterattacks. The ultimate object of the attacks was to separate the British from the French and drive them to the sea.

Haig was expecting a strong attack on the front of his Fifth Army, commanded by Lt. Gen. Sir Hubert de la Poer Gough, late in March. Gough's 15 divisions were deployed sparsely to cover a 41-mile front. The southern 14 miles of his front had recently been transferred by the French through political machinations. Not only was his army overextended, but the area turned over by the French had been organized for defense in a manner different from the British system and was not suited to British defensive tactics. The Third British Army, consisting of 14 divisions and commanded by Gen. Sir Julian H. G. Byng (later 1st Viscount Byng), held the northern sector. These 29 British divisions on the line had the task of stemming the assaults of 71 German divisions—Below, 25; Marwitz, 21; and Hutier, 25. In addition, the German divisions individually were stronger than those of the British. While Haig had expected the German attack, he and the other Allied commanders were completely surprised by its power, ferocity, and tactics.

At 4:40 A.M. on March 21, German artillery (6,000 cannons and 3,000 mortars) began a five-and-one-half-hour bombardment with gas, smoke, and high-explosive shells. At 9:40 A.M., 32 German divisions, followed closely by 28 additional divisions, began the attack in a dense fog. This fog did not hamper the German artillery, which was firing by map, but it affected British defensive fires, especially those of the infantry. During the first day the British front was shattered throughout the zone of attack. By the evening of the second day (March 22), the entire Fifth Army had been forced from its battle position; on the following day, Gough ordered it to retire behind the Somme. Byng's Third Army had lost part of its front line, but since it was defending a deep zone, it was able to hold the German Seventeenth and Second armies to moderate gains. Ludendorff had expected these two armies to make rapid progress while Hutier's Eighteenth Army guarded their south flank. Now he changed his plan to capitalize on Hutier's unexpected success. His armies were directed to drive along both banks of the Somme to the sea, fanning out north and south to strike both the French and the British. He reasoned correctly that the primary concern of the French would be the defense of Paris and that of the British the safety of the Channel ports, and that these divergent interests would prevent cooperation between the Allied forces.

On March 23 and 24, the German advance continued with great speed, particularly in the Fifth Army sector. Gough's rapid retreat exposed the south flank of Byng's Third Army, but the gap was soon filled by British cavalry. By March 26, Amiens, the major link between the British and French, was in peril. These successes caused Ludendorff to expand his plan again by driving northward, first striking Arras: 20 German divisions were thrown toward the

Troops leave their trenches as an attack begins in the last series of German drives on the western front.

The Bestmann Archive





U.S. War Dept., General Staff

French soldiers advance through a desolate stretch of no man's land on the Somme front with the aid of a gas attack.

town, using the new tactics that had created the initial breakthrough. A number of divisions had to be employed that were not well trained in these tactics, however, and this time there were no fog and no surprise. Byng's army now included some of the best British units, and it was posed in an excellent position. The German attack toward Arras was completely repulsed without denting the British line.

Meanwhile, Hutier continued his advance south of the Somme, while French units arrived in dribbles to help Gough, who was fighting a good delaying action. On March 25, Gen. Émile Fayolle assumed command of the mixed French and British units south of the river. By this time, 6 French divisions had arrived, but as Hutier advanced, they tended to fall back to the southwest as if to cover Paris. And this might well have been Pétain's reason for sending even this weak assistance, for he still was convinced that the Germans were about to attack his front between Soissons and Reims and kept most of his reserves disposed to meet such an offensive. On March 27, Hutier captured Montdidier, but his divisions were becoming exhausted, and supplies were not reaching the troops. In the center, Marwitz drove toward Amiens, but he was met near Abancourt by a hastily improvised force of rear area service troops (which included two companies of American engineers) designated as Carey's Force after its commander, Brig. Gen. George Glas Sandeman Carey. For three days (March 28-30), the Germans repeatedly assaulted the old trenches in which Carey had posted his modest force, but to no avail. Ludendorff made two other futile attacks—one on March 30, between Montdidier and Noyon; and the second on April 4, near Albert—and then stopped the offensive.

The first German drive was a brilliant tactical success, having achieved an advance of about 40 miles in eight days. The Germans captured 70,000 prisoners and 1,100 guns and inflicted nearly 200,000 casualties. In a strategic sense, however, the drive was a failure. The British armies had not been destroyed or separated from the French. German manpower losses approximately equaled those of the Allies, but most of their losses had been sustained by the highly trained shock divisions. Moreover, the losses could not be replaced, whereas American

troops were arriving at an accelerated pace to join the Allies on the western front.

**Allied Unity of Command.**—One important result of the first German drive was that it forced the Allies to adopt a system of unified command. The Italian disaster at Caporetto had made it clear that better coordination of the Allied effort was essential, and the Supreme War Council had been formed in November 1917. Lloyd George and Premier Georges Clemenceau wished to give the council control of a general reserve of 30 divisions, but Haig contended that he could not spare his quota. Instead, he devised with Pétain an arrangement for mutual assistance if necessary. "I can deal with a man but not with a committee," said Haig. The arrangement failed in the acid test of the first German drive. As the Germans pressed forward, Haig called on Pétain for help; Pétain agreed to send a few divisions. Haig wanted more, but the French commander refused because he expected a German attack near Reims. Furthermore, he announced that in the event of a retreat his troops would withdraw to the southwest to cover Paris. This decision alarmed Haig, for such a move would create a large gap between the French and British forces that would invite disaster. He reported to the British secretary of state for war, Viscount Milner, that the Allies would be defeated unless "Foch or some other determined general who would fight" was placed in supreme command of the Allied forces in France.

On March 26, the Allied leaders assembled at Doullens. Clemenceau suggested that Gen. Ferdinand Foch be "charged with the coordination of the action of the British and French armies in front of Amiens." Haig and Pétain called attention to the inadequacies of such an arrangement and urged that Foch be given authority over all the British and French operations on the western front. This course was finally approved as an emergency measure during the crisis; on April 3, Foch was given authority over the American forces as well, and on April 14 he was formally made commander in chief of all the Allied armies in France. Foch thereafter led the Allies to victory, but not so much by legal authority as by military acumen, determination, and force of personality.

**Second German Drive (Lys Offensive), April 9-29.**—Though his first drive had failed,

Ludendorff hoped that one more blow would shatter the British Expeditionary Force (BEF). The Germans still had reserves which could be used in an attack, and preparations had been made for one near Ypres as a deceptive measure to cover planning for the first drive. These preparations and an excellent rail network would permit a rapid regroupment and an attack in Flanders, although it could not be made on the scale of the Somme offensive. Gen. Sixt von Armin's Fourth Army was to attack north of Armentières, and Gen. Ferdinand von Quast's Sixth Army south of the town. Only 35 divisions were available for the two attacks, and they were much inferior to those employed in March. There were no cratered fields in the zone to hinder an advance, but the country was cut up by hedges, canals, dikes, and small streams, which would facilitate a British delaying action.

At 8:45 A.M. on April 9, after an intensive bombardment consisting largely of gas shells, 8 divisions of the German Sixth Army struck south of Armentières, where 3 divisions of the First British Army of Gen. Henry Sinclair Horne (later 1st Baron Horne) held the front. The center division was a Portuguese unit that was occupying not only its own sector, but also that of another division, pending relief by 2 British divisions on April 10. The German blow sent the overextended Portuguese fleeing to the rear and crushed the British division on their left. Within three hours, Quast's troops had passed through the entire trench system and were in the open, and by day's end they had advanced five miles. The next day, Armin's Fourth Army attacked north of Armentières, concentrating 4 divisions against a single British division sector on the front of the Second British Army, commanded by Gen. Sir Herbert C. O. Plumer (later 1st Viscount Plumer). This attack succeeded largely because British reserves had been drawn southward by Quast's attack of the previous day. On April 11, the two German armies joined forces and advanced westward.

By the morning of April 12, the BEF was in extreme danger, and preparations were made for evacuating Calais and for flooding the countryside. Meanwhile, Haig rushed all the reinforcements he could find to the scene and pleaded with Foch for more. The supreme commander had been trying to scrape together reserves for a major Allied counterattack. Since the First Battle of Ypres, Foch had admired and developed great confidence in the British soldier's tenacity on the defensive. Despite Haig's angry protests, he therefore sent only relatively small forces. His faith in the British soldier was vindicated, for in some of the most heroic fighting of the war the British, with the help of such French troops as Foch sent, stopped the German offensive.

Ludendorff had again achieved a brilliant tactical success and a strategic failure. The drive had cost him 350,000 men to acquire a vulnerable salient; the British lost 305,000 men. The German commander now scraped the eastern front for men, while American reinforcements more than compensated for the Allied losses.

**Third German Drive (Aisne Offensive), May 27-June 6.**—Ludendorff believed that the British were overstrained, and that one additional heavy blow would defeat them. Accordingly, preparations were made for two new attacks in Flanders. Appreciating the fact that

the French and British reserves then in that area could probably stop the attacks of his depleted forces, however, he decided to make a thrust elsewhere to draw the reserves away before launching the two attacks. The area selected for the diversionary attack was the *Chemin des Dames*, a highway along the Aisne between Soissons and Reims. This was precisely the area in which Pétain had feared an attack in March. None having come, it was presumed that the Germans considered the position impregnable, and the garrison had been severely reduced. Since Foch considered the junction between the French and British in the Amiens area the critical point in the Allied line, most of his reserves were posted there. Knowing that the Allies were alert for another attack, the Germans prepared the Aisne offensive with the greatest secrecy. Two weeks before the actual attack, the American intelligence service had predicted its location, but the prediction was ignored by Foch and Pétain. On May 26, definite information was obtained from two German prisoners that the attack would take place on the following day. It was then too late to do more than alert the Allied front-line units. While 8 Allied divisions were started down from the north, they could not arrive in time.

On the morning of May 27, two German armies—Gen. Fritz von Below's First Army and Col. Gen. Max von Boehn's Seventh Army—attacked with 17 divisions in the line and 13 in the rear. Approximately 4,600 guns supported the offensive. Gen. Denis Auguste Duchêne, who was in charge of this sector of the Allied front, had been loath to relinquish the high ground of the *Chemin des Dames* in the front of his position. To ensure its retention, he had placed most of his infantry in the forward defenses, thereby abandoning a defense in depth. The German attack broke through his defenses and by night had raced 13 miles to Fismes, across the Vesle River. Ludendorff had planned to stop there and begin his offensive in Flanders, but his troops were moving rapidly against little resistance, and he could not withstand the temptation to let the attack run its course. Three days later, the Germans were on the Marne at Château-Thierry, within 37 miles of Paris.

Pétain now asked Gen. (later General of the Armies) John J. Pershing for an American division to hold the Marne crossings. Pershing had been firm in his intention of engaging American troops as a separate army, but the situation was critical, and he assigned the American 3d Division to the task. The division had never been in action and was then 110 miles away in a training area. A hurried movement by rail and motor brought it to Château-Thierry on June 1. For the next three days the Germans strove to cross the Marne, but the Americans threw them back repeatedly and kept them on the north bank of the river. Meanwhile, other German forces advanced west of Château-Thierry on the road to Paris. The American 2d Division was thrown across the road and in bitter hand-to-hand fighting stopped the foe. Ludendorff now halted the German offensive. It was his greatest tactical success on the western front, but its net result was to leave the Germans in a salient more unfavorable than the two formed in the previous drives.

**Cantigny.**—On May 28, the second day of the German Aisne offensive, an operation took place

that was important not so much for its military impact as for its psychological effect. It was the capture of the village of Cantigny by the American 1st Division, the first offensive operation undertaken by an American division in the war. Cantigny stood on high ground, a factor that gave the Germans good observation over the Allied lines and concealed their own rear-area activities. The offensive was a success in every way. To the Germans, who had been scornful of American fighting ability, this success brought great discouragement, but to the formerly skeptical British and French this display of the fighting potential of American troops was a great encouragement.

**Fourth German Drive (Noyon-Montdidier Offensive), June 9-13.**—After his third drive, Ludendorff found himself in a dilemma. His advance had created a salient that was extremely vulnerable to Allied counterattack. The proper course was to withdraw to a safer military position, but such a move would adversely affect the morale of the German troops and the home front and, simultaneously, would bring joy to the Allied countries. Yet if he did not withdraw from the salient, he would not have enough troops for his Flanders offensive, for which the third drive had been undertaken as a diversionary operation. It was imperative that he not surrender the initiative to the Allies, and he therefore decided on a smaller two-pronged offensive. One thrust would drive southward from the Noyon-Montdidier sector; the other, westward from Soissons. His purpose was to extend the front forward between the Amiens and Aisne salients in order to facilitate supply operations and to threaten Paris. Again he hoped that the threat to Paris would draw reserves from Flanders so that he could undertake his ultimate object: the destruction of the British in that area. On June 9, Hutier's Eighteenth Army attacked from the Noyon-Montdidier sector and Boehn's Seventh Army from Soissons. This time there was no surprise, and the French under Fayolle were well prepared. They had adopted a deep-zone defense against which the German offensive gradually wore itself out. After a tortuous advance of 9 miles the Germans were stopped by French counterattacks. Fighting ceased on June 13. For unimportant gains the Germans had suffered heavy losses, while French losses were light.

**Fifth German Drive (Champagne-Marne Offensive), July 15-17.**—A month of comparative quiet followed the fourth drive. Many German leaders favored making peace overtures, but Ludendorff was resolute. Nonetheless, German troops had shown signs of slackening discipline during the rigors of the Lys offensive. Now, poorly fed and in a weakened condition, they were easy prey for the worldwide influenza epidemic that struck in June. Between 1,000 and 2,000 men in each division had developed the disease. Allied propaganda leaflets, designed to alienate the troops and the people from their leaders, were sent across the lines by balloons. United States troops were arriving in such numbers that, for the first time in 1918, Allied infantry strength on the western front exceeded that of the Germans. Foch was busy assembling forces and preparing for his counteroffensive.

Despite the unfavorable situation, Ludendorff strove to retain the initiative and to gain final victory by two great attacks. One was to cap-

ture Reims; the other, on a much larger scale, was to take place 10 days later in Flanders (this was his final plan to destroy the BEF, which was never to be carried out). In the Reims offensive, Boehn's Seventh Army was to attack southeastward from the Marne salient toward Epemay; Gen. Bruno von Mudra's First Army was to attack southward to capture Châlons-sur-Marne; and, to the east, Col. Gen. Karl von Einem's Third Army was to attack to cover the flank of the First Army. In this stroke, 52 German divisions were to be employed; 36 Allied divisions confronted them—23 French, 9 American, 2 British, and 2 Italian.

Through aerial photography and German deserters (the last drives had been signaled by a marked increase in the number of German deserters on the eves of the offensives), Foch learned of the German plans in detail and took proper countermeasures. He anticipated the German preliminary bombardment with one of his own, which caught the Germans in close formations and inflicted severe losses. The Seventh Army attack toward Epemay was frustrated; that of the First Army gained initial successes, but was finally stopped by a heroic Allied defense. The psychological impact of this setback on the German troops was great. Ludendorff had designed the operations as a diversion to draw Allied reserves from Flanders, but the German troops had called it *Friedensturm* (peace offensive) and had expected it to produce decisive results. This was the last offensive Ludendorff could launch, for Foch had now gained the initiative. During the five drives the Germans lost more than 800,000 men.

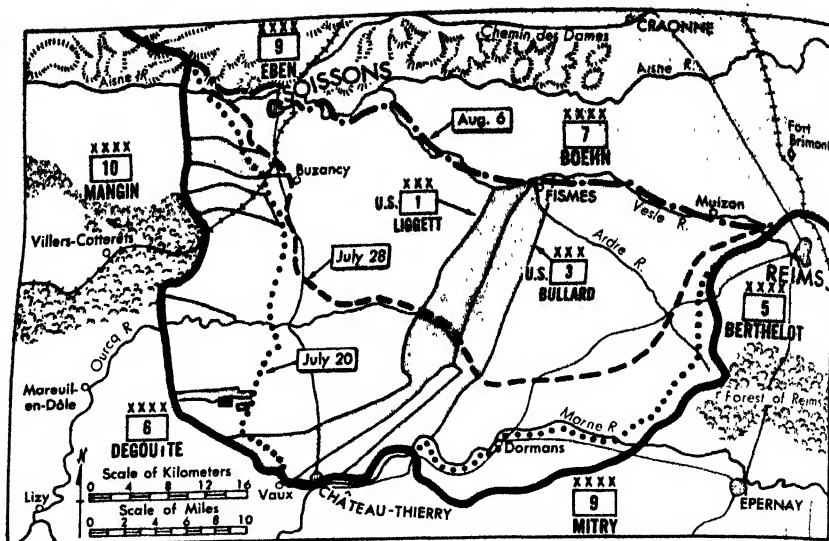
#### REDUCTION OF THE GERMAN SALIENTS

**Aisne-Marne Offensive, July 18-August 6.**—As early as May 20, Foch had planned a counteroffensive to seize the initiative from Germany. His opportunity came with the failure of the fifth German drive. In preparation for a general offensive, he planned to reduce the three prominent German salients so as to improve lateral railway communications along the Allied front and facilitate future operations. The three salients were the Marne salient, created during the third German drive; the Amiens salient, formed during the first German drive; and the St.-Mihiel salient, formed in the autumn of 1914 and relatively quiet ever since. Foch's first objective was the Marne salient, although it was difficult to assemble promptly the means for an offensive there. Haig was called on to provide some of his reserves and responded generously despite the objections of the British cabinet, which was fearful of reducing British strength in Flanders to a dangerous level.

Foch's plan was to attack the Marne salient from all sides. Four French armies were to engage in the offensive; in counterclockwise order these were Gen. Charles Mangin's Tenth and Gen. Jean M. J. Degoutte's Sixth armies, in the western half of the salient; and Gen. Marie Antoine Henry de Mitry's Ninth and Gen. Henri M. Berthelot's Fifth armies, in the eastern half. Included in these armies were 8 American, 4 British, and 2 Italian divisions. Mangin was to make the main assault. Early on July 18, he struck with 20 divisions (including 2 American

<sup>1</sup> This offensive and the Champagne-Marne offensive of July 15-17 together are often referred to as the Second Battle of the Marne.

**REDUCTION OF THE MARNE SALIENT (Aisne-Marne offensive; July 18-Aug. 6, 1918).** Gen. (later Marshal) Ferdinand Foch planned to launch a general offensive as soon as the German drives had spent themselves. First, however, it was necessary to reduce several salients occupied by the Germans which restricted Allied lateral communications along the front. The Marne salient, created during the third German drive, was attacked by Allied forces, predominately French, from three sides in July. In a brilliant operation the Allies forced the Germans back to the Vesle and Aisne rivers, thus straightening the front.



and 2 British) and 350 tanks. An hour later, Degoutte joined the attack on Mangin's south flank, and by nightfall the Tenth and Sixth armies had advanced from 2 to 5 miles. (This was the greatest and most successful use of tanks by the French during the war.) On July 19, Mangin continued to advance toward Soissons and the Soissons-Château-Thierry road, the vital artery of the German salient, although more difficult terrain and mechanical failures were beginning to render the tanks less effective. Modest gains were made by the other French armies on this day.

Alarmed by Mangin's threat against the key communications center of Soissons, the Germans decided to withdraw from the Marne salient. The withdrawal was conducted skillfully and in good order. The Germans delayed at successive positions, defending each resolutely while evacuating supplies and equipment to the rear, until the pressure of the Allied attacks compelled them to retreat. By August 3, they had withdrawn to a strong position at the base of the salient behind the Vesle and Aisne rivers, where they held fast. On the morning of August 6, 2 American divisions attacked this position. Minor gains were scored, but it was not broken. The Marne salient had been eliminated; the French had gained a glorious victory, but they did not forget to express their gratitude for the help of their British and American allies. This, the first significant Allied success of the year, brought relief in the Allied homelands; Paris was jubilant. On August 6, Foch received his baton as a marshal of France.

The largest American contingent thus far had participated in the operation. For the first time, American divisions were formed into corps. Near the end of the battle the American 1st and 3d corps held the entire front of the French Sixth Army. American divisions had been used as spearheads in the offensive and had performed in a manner to gain praise from their allies. A total of 8 American divisions had been engaged in the offensive, but the number does not indicate the true magnitude of American participation. Each division, comprising 28,000 men, had twice the infantry strength of a British, French, or German division. The organization of the

American division has been criticized by many (including Americans), but its huge size did give it integral power for sustained operations, thereby necessitating fewer shifts of divisions between front and rear—a distinct advantage in the warfare of the times in France.

German losses in the Aisne-Marne offensive were heavy but not ruinous. What was more important, the initiative had now passed to the Allies, where it would remain until the end of the war. Ludendorff's cherished Flanders offensive had become a dream, and it was clear that his hope of crushing the Allies before the United States could put a large force in the field would not be realized.

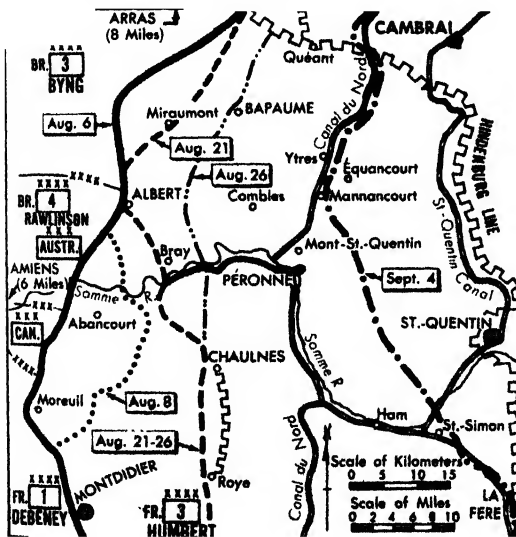
**Reduction of the Amiens Salient, August 8–September 3.**—In mid-July, plans were developed for operations against the Germans in the Amiens salient, and preparations were begun. The main attack was to be made almost directly eastward from Amiens by the Fourth British Army of Gen. Sir Henry Seymour Rawlinson (later 1st Baron Rawlinson); assisted on the right by Gen. Marie Eugène Debeney's First French Army. Gen. Georges Louis Humbert's Third French Army was to exert pressure against the southern face of the salient. Rawlinson amassed on a 10-mile front a powerful striking force: 17 infantry divisions (including 1 American division and two of the best fighting corps on the western front—the Canadian Corps of 4 divisions and the Australian Corps of 5 divisions); 3 cavalry divisions; about 600 tanks, the majority of which were of a new and much-improved type; 2,000 guns; and 800 fighter and bomber aircraft. Debeney had 10 divisions but few tanks; he was to be supported by 1,100 aircraft. To oppose this avalanche the Germans had two armies—Marwitz's Second and Hutier's Eighteenth—totaling 20 divisions, mostly of dubious quality, supported by few tanks and less than 400 aircraft.

Because of the disparity in numbers of tanks, the attacks of the British Fourth and the French First armies were to differ. Rawlinson was to use the tactics which had proved so successful at Cambrai in November 1917. There the tanks followed by the infantry had advanced under the cover of a rolling barrage. Since surprise was essential in this type of attack, no artillery



was to be used. Debeney, lacking tanks, had to attack conventionally. His offensive was to be delayed about an hour in order to allow for artillery preparation and yet not jeopardize the surprise of the British attack.

At 4:20 A.M. on August 8, the British Fourth Army struck in a helpful mist, and Debeney joined in the attack at the appointed time. Although Ludendorff had taken special precautions to strengthen this important part of the front, it now collapsed. The German infantry could not stand up against the British tanks, and 6 divisions, considered battleworthy by Ludendorff, gave way at once. It was not the effectiveness of fire from the tanks that demoralized the Germans (this was wobbly and erratic), but the inexorable advance of the steel monsters against infantrymen who had no defense against them. (Advancing against artillery fire, tanks usually suffered about 25 percent casualties a day in an attack.) Within two hours the British had taken 16,000 prisoners and 200 guns; by noon tanks and armored cars, as well as cavalry, were 9 miles to the rear of the German lines. Debeney's advance had not been as spectacular as that of the British, but it progressed successfully. This great Allied victory caused Ludendorff to call Aug. 8, 1918, the "black day" of the German Army, since for the first time entire units collapsed. Retreating troops called out to reinforcements marching toward the front: "You're prolonging the war."



**REDUCTION OF THE AMIENS SALIENT (Aug. 8-Sept. 3, 1918).** The Amiens salient was created during the first German drive. In August, Allied forces, predominately British, strongly supported by tanks, forced the Germans to give way and drove them back to the Hindenburg Line, from which they had started their first drive in March.

By August 10, the Canadian and Australian corps and the Cavalry Corps had advanced 12 miles and were close to the strong German Roye-Chaulnes position. The French First Army was rapidly catching up, and Humbert's Third Army was successfully driving northward. Foch urged Haig to exploit these successes and drive straight east to the Somme, but Haig insisted that the Roye-Chaulnes position was too strong to be broken without extensive preparations, including

the moving up of heavy artillery. Instead, he wanted to suspend the attack and to open a new one with Byng's Third British Army on the north flank of Rawlinson's Fourth Army. Foch finally agreed to this plan, and Haig shifted his reserves to the north for the new drive, which was to be opened on August 21. The Germans conducted a zone defense before Byng's attack, falling back 3 miles to their main position. From there they counterattacked on August 22. The crafty Haig had foreseen this maneuver, however, and had engaged only part of his force on the first day. Hence he was able to beat off the counterattack and maintain his momentum. On August 23, he ordered a general advance along a 30-mile front. The increasing pressure in the north caused the Germans to evacuate the Roye-Chaulnes position, as Haig had predicted. In brilliant operations the Australians captured the dominating heights of Mont-St.-Quentin on August 30-31, and two days later the Canadians broke the elaborate German switch position east of Arras. The Germans then withdrew to the Hindenburg Line, whence they had started their first drive five months earlier. The Amiens salient had been wiped out.

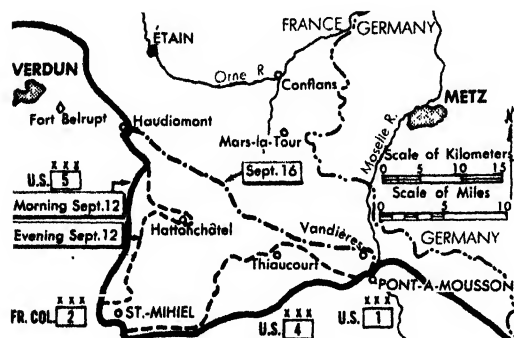
The mounting German disasters brought on during August a crown council at which governmental and military leaders discussed their future actions. Ludendorff offered his resignation, but it was refused. The decision was made to fall back fighting and to maintain a foothold in France as long as possible. Peace negotiations were to be opened through the mediation of neutrals, but, as it turned out, little was done for some time.

**St.-Mihiel Offensive, September 12-16.**—By early July, 25 United States divisions were in France; of these, 12 were trained and had engaged in or were ready for combat. On July 24, General Pershing ordered the formation of Headquarters, United States First Army, with himself as commander, to be effective on August 10. It had been planned to have this headquarters assume control of the 1st and 3d American corps, then engaged on the Vesle. When the situation was stabilized there, Pershing obtained Foch's permission to take over the St.-Mihiel sector instead, leaving 3 or 4 divisions on the Vesle under French command.

The St.-Mihiel salient hampered rail communications between Paris and Lorraine, and its reduction was necessary before Foch's final offensive could be undertaken. In addition, it was important to the Germans, since it covered Metz and the Briey iron mines; and for these reasons this naturally strong position had been carefully fortified. The severe fighting earlier in 1918 had made great inroads in the Germans' manpower, however, and had forced them to economize wherever possible. To further this purpose a step-by-step withdrawal from the St.-Mihiel salient had already been ordered, and the removal of heavy materials and some relatively immobile artillery pieces had begun on September 11, the day before the American attack.

By the end of August, Pershing had nearly completed his plans and preparations for the St.-Mihiel offensive. Now Foch, elated by the success of the Aisne-Marne and Amiens offensives, planned to reduce the scope of the St.-Mihiel offensive and to divide the American forces into three groups to operate in different

areas. A heated controversy ensued between Foch and Pershing. The latter saw the advantage of pressing the enemy and of giving him no respite, as Foch proposed, but he saw no valid reason for splitting his own forces. When Foch insisted, Pershing remained adamant, replying, "While our army will fight wherever you may decide, it will not fight except as an independent American army." Finally, a compromise was reached; the United States First Army would remain intact, the objective of the St.-Mihiel attack would be limited to capturing the base of the salient, and the First Army would then take over the Meuse-Argonne sector as its major role in the final offensive.



**REDUCTION OF THE ST.-MIHIEL SALIENT** (St.-Mihiel offensive; Sept. 12-16, 1918). The St.-Mihiel salient was created during the initial German offensive in 1914 and had been practically dormant ever since. The task of reducing the salient was given to the American First Army (with one French corps attached) as its first operation as an independent army. Appreciating their vulnerability in this exposed salient, the Germans had begun to evacuate heavy equipment and materials before the attack was launched. German resistance to the American attack was not determined, and the salient was reduced in four days.

The plan for the St.-Mihiel offensive provided for attacks by three American corps (1st, 4th, and 5th) on the flanks of the salient, while the 2d French Colonial Corps drove against its nose. As an army, the United States First Army was decidedly unbalanced. During the dark days of the early German drives, the British and French had pleaded for American infantry and machine-gun units to fill their most pressing needs. Priority had accordingly been given to the shipment overseas of these types of units. Now the First Army found that it was dependent on the British and French for heavy support. This was cordially given: most of the 3,000 guns to support the attack were provided by the French; the 267 light tanks to be employed also were French, some being manned by French crews and some by American; and the air force of 609 American planes was increased to nearly 1,500 by the attachment of French, British, Italian, and Portuguese units.

The battle opened at 1 A.M. on September 12 with an intensive artillery preparation, and at 5 A.M. the infantry jumped off. Resistance was generally light, and by day's end most of the American units had reached their second-day objectives. By evening of September 13, all objectives had been taken, and the salient had been reduced. A much greater advance could probably have been made, but since Pershing was committed to the impending Meuse-Argonne

operations, the St.-Mihiel attacks had to be halted. French units began relieving the American divisions so that the latter could be moved immediately to the Meuse-Argonne area.

The St.-Mihiel operation was a well-executed limited offensive. It was not a hard fight, but American commanders and their staffs there displayed their competence to handle a large operation, as American troops had proved their fighting qualities in the Aisne-Marne offensive.

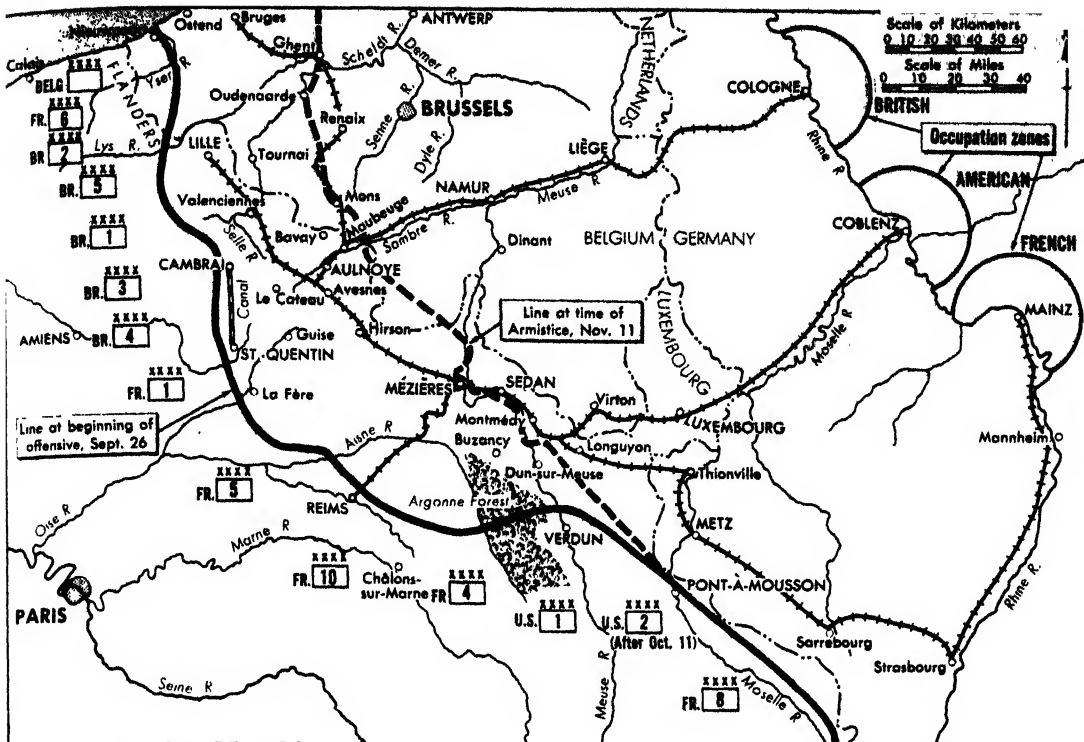
#### ALLIED FINAL OFFENSIVE

**Foch's Plan.**—Since June, Foch had been contemplating a general offensive in September, but he apparently did not believe that such an offensive would be decisive at that time, for he continued to urge the British and Americans to strengthen their forces for a decisive effort in 1919. Nevertheless, the Aisne-Marne and Amiens victories had clearly demonstrated the superiority of the Allied armies. To Foch this ascendancy seemed to justify an attempt to gain the victory in 1918. The British cabinet was reluctant to permit Haig to engage in such an enterprise, believing that the final drives could not be made before 1919, but the general went to London and persuaded the cabinet to accept Foch's view.

Foch realized that his offensive could be frustrated by a rapid withdrawal of the Germans to the frontiers, combined with the thorough demolition of roads and railways in their wake. Such a retreat would compel the Allies to build new communications as they advanced, and it would probably be impossible for them to make a major coordinated attack against the German frontiers before the spring of 1919. A rapid German withdrawal would necessitate the abandonment of vast stores of supplies and equipment that had been built up in France and Belgium, however, and the German General Staff could not reconcile itself to this sacrifice. Understanding all of these factors, Foch is said to have remarked: "The man could still escape if he did not mind leaving his luggage behind." The key-stone of Foch's offensive plan accordingly became the prevention of an orderly, step-by-step evacuation by the Germans.

The German armies depended for supply (and would have to depend for evacuation) primarily on the railroad running from Cologne through Liège, Namur, and Maubeuge. Another line ran from Coblenz up the Moselle Valley to Luxembourg and Virton, and a third ran southward along the west bank of the Rhine River to Strasbourg and thence northwestward to Metz. The great lateral railroad was the Bruges-Ghent-Maubeuge-Mézières-Metz—line, from which branches ran to the fighting front. The key rail junctions were Aulnoye and Mézières, and the loss of these places would deprive the Germans of their principal capabilities for withdrawal. Foch's general plan, then, was to capture both junctions rapidly by means of two major converging offensives. One offensive, mainly British, was to drive eastward to Aulnoye; the other, mainly American, was to drive northward to Mézières and Sedan.

For his final offensive, Foch had 220 divisions: 102 French, 60 British, 42 American, 12 Belgian, 2 Italian, and 2 Portuguese. Besides having twice as many infantry troops as the other divisions, the American divisions were at full strength, while the other Allied divisions were below strength. On the line were 160 divisions



**ALLIED FINAL OFFENSIVE (Sept. 26–Nov. 11, 1918).** The obstructive salients having been reduced, Foch launched his general offensive on September 26. His objective was to capture the key rail junctions of Aulnoye and Mézières, thus preventing an orderly withdrawal by the Germans and leaving them vulnerable to destruction. To execute the plan, a Franco-British pincer was to advance rapidly to Aulnoye from the west, and a Franco-American pincer to Mézières from the south. The Germans prevented the pincers from closing and withdrew in fair order, though suffering heavy losses. Recognizing the hopelessness of their cause against the massive and relentless Allied offensive, the Germans asked for an armistice. It was granted, effective November 11.

60 were held in reserve. To oppose the Allied offensive the Germans had 197 divisions: 113 in line and 84 in reserve. Only 51 of these divisions were classified by the Allies as effective fighting units, however, and all were under strength. News from a disillusioned home front further depressed the already low morale of the German troops. Ludendorff braced his forces as best he could for the impending blows. Special counterattack divisions, composed of selected men and better armed and equipped than the other divisions, were kept in reserve to counter any Allied breakthrough.

Though Foch intended a sort of pincers operation with a British-French pincer moving from the west and an American-French pincer moving from the south, his plan provided for aggressive action by all of the 160 front-line divisions. *"Tout le monde à la bataille"* ("Everyone in the fight") was his expressive description of the offensive. Fully aware of the scarcity of the German reserves, he planned to stagger his attacks in order to confuse the enemy and keep him off balance. Should the German reserves be directed to counter one Allied attack, subsequent attacks elsewhere might find easy going. Foch had employed this scheme of staggered attacks in the Aisne-Marne offensive with excellent results.

The offensive was to be initiated on September 26 by the southern pincer (the American First Army, with the French Fourth Army on its left), with Mézières-Sedan as its objective. The western pincer would begin its attack toward

Aulnoye on September 27 with the British First and Third armies. The British Fourth and French First armies, to the south, would join the attack on September 29, with the French First Army on the right. The French Fifth and Tenth armies were to advance in the center between the French First and Fourth armies in order to maintain pressure on that front and prevent the movement of German troops to other sectors. It was hoped also that these troops would be trapped by the converging pincers. In the Flanders area three armies—the Belgian, French Sixth, and British Second—under King Albert I would attack toward Ghent on September 28. The British Fifth Army was to cover the gap between King Albert's and Haig's army groups. The remainder of the western front, south of the American First Army, was held by Gen. Édouard de Castelnau's French army group, with the French Eighth Army adjacent to the Americans. Castelnau's forces were to play only a defensive role in the offensive.

The grouping of forces for the final offensive indicates the degree of mutual confidence and cooperation among the Allies under Foch. French troops served enthusiastically under British, Belgian, and American command; British, under French and Belgian command; and Americans (6 divisions), under French and British command. In fact, there was greater harmony among commanders of different nationalities than among those of the same.

For simplicity and continuity in tracing the

complex operations of the many Allied armies, they are classified here into four groupings. From north to south these are the Flanders offensive, the western pincer (Cambrai-St.-Quentin), the operations of the French center, and the southern pincer (Meuse-Argonne). The operations are further divided into two time periods: September 26–October 31, and November 1–11.

**Operations, September 26–October 31.—Southern Pincer (Meuse-Argonne).**—The mission of the American First Army, as stated by Foch, was to drive the enemy behind the Sedan-Mézières rail line before winter weather made offensive operations difficult. The French Fourth Army would attack on the American left. Both armies would effect a junction north of Grandpré, at the northern end of the Argonne Forest. Before the offensive could be launched, 220,000 men of the French Second Army had to be moved from the Meuse-Argonne sector, while 600,000 American troops moved in from the St.-Mihiel front and from the rear. Through remarkable staff work the move was accomplished smoothly and expeditiously. Because of the short interval between the end of the St.-Mihiel offensive and the contemplated final drive, however, most of the experienced American divisions could not be brought up in time to lead the Meuse-Argonne attack. Consequently, of the 9 divisions that were to take part in the initial attack, 5 had not been previously engaged in combat and 4 did not have their own artillery.

An advance in the Meuse-Argonne sector posed a serious threat to the entire German position on the western front. The Germans therefore had carefully fortified the zone during the four years they had occupied it. Three main lines of defense had been thoroughly organized, and almost every wood and village between them had been fortified as a strong point. In addition, every possible route of advance was

covered by Germans on dominating ridges, and the rugged and thickly wooded hills of the Argonne Forest themselves provided strong obstacles.

At 5:25 A.M. on September 26, after a preliminary bombardment, Gen. Henri J. E. Gouraud's Fourth French Army advanced, and five minutes later Pershing's American First Army moved forward. The French advance was hampered by mine craters and shell holes, which had been created during the operations of previous years, and by strong German positions on the commanding heights. It had progressed only 3 miles by the evening of September 27; by October 1, after three days of bitter fighting, Gouraud had advanced 6 additional miles; by October 9, his offensive had gained only another mile and a half. Meanwhile, the American assault on September 26 had encountered only 4 German divisions on the front line. By evening the surprised Germans had been beaten back 5 miles along the Meuse but only 2 miles in the difficult Argonne Forest. The advance continued until October 1, but meanwhile German resistance had stiffened. Although the first two German positions had been broken, the American effort spent itself before reaching the third position. After the relief of units and reorganization the attacks were resumed on October 4.

The next four weeks saw a grueling series of frontal attacks, during which the Americans beat their way through the third German defensive position as casualties mounted rapidly. Meanwhile, Pershing launched an offensive across the Meuse to clear the heights on the east bank. This sector was turned over to the newly formed American Second Army, under Lt. Gen. Robert L. Bullard. Lt. Gen. Hunter Liggett was given command of the First Army, and Pershing thereafter acted as army group commander. By October 31, the Argonne Forest had been cleared, and the Americans had advanced 10 miles beyond their starting line of September 26. Gouraud's Fourth Army had broken through the desolated area on its front into open ground and by October 31 had reached the Aisne River, 20 miles from its starting points.

The slow though steady progress of the American First Army during this phase of the battle was highly unsatisfactory to Clemenceau, who suggested to Foch that he try to have Pershing relieved of command. Foch, however, had "a more comprehensive knowledge of the difficulties encountered by the American Army," and declined to support such action. As a matter of fact, the American First Army was accomplishing far more than its limited territorial gains indicated. The threat of its slow but persistent advance had alarmed Ludendorff, who eventually sent 27 of his precious reserve divisions to the American front, thereby facilitating the progress of the other Allied offensives.

**Western Pincer (Cambrai-St.-Quentin).**—Four Allied armies were poised to move eastward on the Cambrai-St.-Quentin front. From north to south these were the British First (Horne), Third (Byng), and Fourth (Rawlinson) armies and the French First Army (Debeney). The British First and Third armies were to attack on September 27, one day after the attack of the southern pincer; the Fourth and French First armies would move out on September 29, in consonance with Foch's plan of staggered attacks. Between Haig's armies and their objective, Aulnoye, lay

Troops of the American First Army in Varennes, taken as the Meuse-Argonne offensive begins on Sept. 26, 1918.

U. S. Signal Corps





(Left) U.S. Signal Corps; (right) Imperial War Museum, London

Left: Generals Ferdinand Foch and John J. Pershing at the latter's headquarters at Chaumont in 1918. Right: Marshal Joseph Joffre and Sir Douglas Haig at Beauquesne in 1916.

canals, rivers, and German defensive positions, including in the southern sector the formidable Hindenburg Line with its three deep defensive positions. At dawn on September 27, the British First and Third armies began their offensive without preliminary bombardment in order to gain surprise. The attacks progressed according to plan but not as rapidly as had been anticipated; by the night of September 28, they had broken through the German defenses to a depth of 6 miles. This success, plus the American early successes on the Meuse-Argonne front, convinced Ludendorff of eventual German defeat. On the night of September 28, he reported to Field Marshal Paul von Hindenburg that there was no chance of an improvement in the German situation, and that efforts to obtain an armistice should be begun. The following day, Hindenburg reported to his government that "the situation demands an immediate armistice in order to avert a catastrophe." On October 4, German and Austrian notes proposing an armistice were forwarded to President Woodrow Wilson.

Meanwhile, on the morning of September 29, Rawlinson's Fourth Army joined the attack, with Debeney's First French Army advancing on its right as flank protection. An intensive bombardment had been started on the night of September 27 along the Fourth Army's front, and it had been continued through the night of September 28. This lengthy bombardment was necessary because the attack had to be made across the St.-Quentin Canal, and tanks could not precede the infantry in the assault. Artillery had to be employed to

soften the German defenses, preparatory to forcing the canal. The effect of this sustained bombardment was to drive the Germans deep into their shelters and to prevent the delivery of food and ammunition to the front-line troops. Moreover, since most of the German troops on the line were either new conscripts or recent arrivals from the eastern front, the demoralizing effect of the bombardment was great. In a determined attack, British, Australian, and American troops hurled themselves at the tunnel defenses and swam the canal. The ferocity of the attack panicked the Germans, who abandoned their machine guns and positions and fled to the rear. By nightfall the Fourth Army had captured the advanced position of the Hindenburg Line and a good part of the second position. All three British armies were now engaged in a slow but inexorable advance. On September 30, Cambrai was enveloped on the north and south, but the Germans were not cleared from the town until October 9. St.-Quentin was flanked by the Fourth Army, evacuated by the Germans, and occupied by the French First Army on October 1-2. By October 5, the third and last position of the Hindenburg Line was in British hands. With his front giving way, Ludendorff withdrew his forces to a new position along the line of the Selle River. His special counterattack divisions had proved ineffective not only because they were too few in number, but also because the front-line troops in assaulted areas would not hold positions long enough to permit their arrival.

The Allies moved to the line of the Selle, and on October 17 the British Fourth and French



First armies attacked the German positions from Le Cateau southward. The German troops, exhorted by appeals to hold fast in defense of the fatherland, fought well, but after two days of bitter combat they withdrew before the two Allied armies. At 2 A.M. on October 20, the British First and Third armies attacked the northern sector of the Selle position. The infantry crossed the river and, assisted by tanks, assaulted the high ground along the east bank. Again the Germans fought stubbornly, but they were eventually driven off. The three British armies and the French First Army on their right continued the advance through seas of mud, hampered by German mines and demolitions. By the end of October they had reached the next German position, which lay behind the Scheldt River and extended southward to the vicinity of Laon.

**Flanders Offensive.**—King Albert's army group was to attack on September 28, the day between Haig's assaults of September 27 and 29. The offensive of his three armies (from north to south, the Belgian, French Sixth, and British Second armies) began well despite persistent heavy rains. By October 1, the advance had progressed 8 miles and had succeeded in recapturing the Ypres Ridge. The grave threat of Haig's attack to the south had influenced Ludendorff to send reserves to that area. These were few, and, forced to make a choice, he decided to draw troops from the Flanders front. Some 5 German divisions were left in Flanders, and these their commander said would "no longer stand up to a serious attack." The principal obstacle to the Allied advance in Flanders was rain, which made the limited road net almost impassable and bogged down supply and transportation systems. The impasse lasted for two weeks, and it was not until October 14 that serious operations could be resumed. On October 20, the Lys River was reached. By October 28, the successes of Haig's armies in the Selle battles had forced a general German withdrawal, and Albert's armies advanced that day without serious opposition to the German position on the Scheldt. Though not as strenuously engaged as the troops in the two principal offensives, the king's army group played its role well in the execution of the over-all plan.

**Operations of the French Center.**—Four French armies participated in the offensive in the sector between Haig's British and Pershing's American armies. The role of the French First Army at the right of the British advance and that of the French Fourth Army on the American left have been described. Between these two armies the line was held by the Fifth and Tenth armies, whose task was to harass the enemy on their fronts, prevent their movement to other fronts, and hamper their withdrawal so that they might be trapped by the British and American pincers. This relatively passive assignment was an odd one for Frenchmen who had been imbued with Foch's philosophy of "*l'attaque, toujours l'attaque*" ("keep on the offensive")—a philosophy which, under Gen. Joseph Joffre's skillful guidance in 1914, had turned the tide at the Marne after two heartbreaking weeks of retreat and had led the French to a brilliant victory; and which, conversely, in the hands of the obstinate and pompous Nivelle, had led brave Frenchmen to disaster at the Aisne in 1917, with consequent demoralization and mutiny in the French Army. Nevertheless, the French played their unusual role well, but the pincers did not close, and by October 31

the Germans in the center had withdrawn to a shortened line. This shortening of the line required fewer French troops in this section of the front, and some were withdrawn and formed into a new Tenth Army (the old Tenth Army remained in position, but was renamed the Third). The new army was sent to the Lorraine front, to the right of the Americans, where, with the French Eighth Army, it was to engage in an offensive northward on both sides of Metz. This offensive was scheduled for November 15, but the armistice on November 11 made it unnecessary.

**German Situation.**—On October 31, the Germans in the north held the line of the Scheldt. This position had not been fortified as strongly as the Hindenburg Line or the defenses of the Selle, for the Germans had had great confidence in the impregnability of their forward defenses. In the south, in front of the French Fourth and American First armies, they still held the greater part of the formidable Kriemhilde Line and the Bourgogne Wood, just north of the Argonne Forest. The setbacks of the past month, however, had lowered the morale of the German troops to the danger point. German sailors had already lost their fighting spirit, and on November 3 they mutinied at Kiel. Within a few days revolutionary councils of soldiers and workers, like those of the Bolsheviks in Russia, had been established in a number of German cities. These uprisings, combined with the collapse of Germany's allies in late October, created serious unrest, but the military press agencies (through which all military information now passed) continued to try to deceive the people with favorable reports of activities at the front, describing reverses as planned withdrawals to stronger positions.

Nevertheless, Ludendorff was confident of German capabilities to effect an orderly withdrawal to the line of the Meuse, using the time thus gained to secure better armistice terms. President Wilson's reply to the German request for an armistice had not been to Ludendorff's liking. It had prescribed the acceptance of Wilson's Fourteen Points, the cessation of submarine warfare, and the evacuation of all occupied territories as preliminary requirements. The German government was convinced of the hopelessness of the situation, however, and on October 20 signified its acceptance of Wilson's terms. The president then referred the matter to the Allies jointly.

The Reichstag suggested that "the defeated general [Ludendorff] should offer his resignation and retire." Instead, on October 25, Ludendorff issued an order of the day to the troops in which he described the armistice terms as unacceptable. On October 27, the kaiser informed Ludendorff of his intention to consult other generals, whereupon Ludendorff tendered his resignation; the kaiser hastened to accept it. Gen. Wilhelm Groener, who replaced Ludendorff, realistically considered the lack of reserves, the morale of the troops, and the near collapse of the railway system. Each day he reported progressive deterioration; finally, on November 6, he urged that an armistice be effected not later than November 9 to avoid chaos. Soldiers' councils had already been formed at the front; and on November 8, a large group of senior officers, called from the front for a conference with the chancellor, Prince Max of Baden, agreed that the army could not be relied on if it were ordered to quell uprisings

at home. By now the longing among the civilian population for peace had become the paramount consideration. Almost all Germans turned against the kaiser as the one who prolonged the war solely to perpetuate his regime. On November 9, Prince Max announced William's abdication, and a German Republic was proclaimed.

**Allied Operations, November 1-11.**—By November 1, the Allied armies had consolidated their positions, put their supply lines in order, and brought up ammunition and supplies for a continuation of the offensive. Foch's plan of operations for this final phase of his general offensive was substantially the same as his initial plan. The major thrusts would be delivered by the British in the west and the Americans in the south, both being aided by the French armies on their flanks. The British would force the line of the Scheldt, advance to Maubeuge, and press on to capture crossings of the Meuse from Namur to Dinant. If these crossings could be captured before the Germans withdrew from Flanders, they would be pressed against the Dutch border and captured. In the south the rapid seizure of Mézières and Sedan by the American First and French Fourth armies would, it was hoped, isolate the Germans facing the French center armies.

**Allied Attacks from the South.**—On November 1, in cold, wet weather (which continued along the entire western front until the end of hostilities), Liggett's American First and Gouraud's French Fourth armies attacked astride the Bourgogne Wood. On that day, they advanced 5 miles; on November 2, they drove 6 miles farther, the Americans capturing Buzancy. Constant pressure affected the already low morale of the German troops, who finally broke, offering little resistance. On November 3, the Americans drove 5 miles through the German lines and joined forces with the French Fourth Army beyond the Bourgogne Wood. This advance brought the rail line running southeastward from Sedan within range of American artillery, and it quickly pounded the rail centers of Montmédy and Longuyon, through which the Germans were attempting to withdraw troops and supplies. By November 7, the American 1st Corps had pushed back German rear guards and reached the heights of the Meuse overlooking Sedan, for an aggregate gain of 21 miles since November 1. Gouraud's troops, confronted with the task of breaching strong defenses, and with a greater distance to go, reached the Meuse opposite Mézières on the evening of November 10. At this juncture, Foch shifted the left boundary of the American First Army to the east of Sedan to allow the French to capture that city, and thus erase the stigma of the disastrous defeat by the Germans there in 1870. The two armies closed up to the Meuse before the armistice on November 11 halted operations.

As the offensive moved northward, the American 3d Corps crossed the Meuse to the east and occupied Dun-sur-Meuse on November 4. Subsequently, three French corps on the left wing of the American Second Army advanced through the hills east of the Meuse, and at the time of the armistice these American and French troops were within 6 miles of Montmédy. On November 10, the American Second Army began an offensive toward Briey, which was halted by the armistice after slight gains had been made.

**Allied Attacks from the West.**—The British also began their final phase of the offensive on



U.S. War Dept., General Staff

Gen. Erich F. W. Ludendorff (second German officer from left) and Field Marshal Paul von Hindenburg (third from left, in profile) in Brussels in August 1918.

November 1. Haig's first task was to force the German defenses of the Scheldt. To avoid the difficult terrain and intricate dike system immediately in front of his forces, he made his principal attack south of Valenciennes, using elements of the British First and Third armies. By the night of November 2, the Canadian Corps had captured the town. On November 4, Haig launched a general offensive on a 30-mile front, which by evening had advanced 5 miles beyond Valenciennes. On the British right, Debeney's First French Army advanced to the north of Guise. The fighting had been bitter, but the Scheldt position had definitely been turned, and German resistance collapsed. Meanwhile, south of Ghent, French and American units of King Albert's force drove the Germans back from the Scheldt, and the Americans captured Oudenaarde (Audenarde).

The Germans withdrew all along the line, hampered by blocked roads, traffic snarls, a shortage of rail equipment, and Allied air attacks on their retreating troops and transport. On the other hand, the Allied pursuit was slowed because of lengthening supply lines and the methodical demolition of supply routes by the Germans as they withdrew. On November 7, the British entered Bavay; on November 8, Avesnes; and on November 9, Maubeuge. The French armies, following up the advance of the British and Americans on their flanks, took Hirson on November 9. King Albert's troops joined in the pursuit, which now extended along the entire front. Tournai and Renaix (Ronse) were occupied, and a Canadian division entered Mons a few hours before the armistice.

**The Armistice.**—The Allies had left the details of the armistice terms to be arranged by their military leaders. Pershing objected to granting an armistice at all, preferring to continue the attack until the German forces were obliged to lay down their arms in the field. Foch's view was that additional bloodshed was unnecessary if the terms of the armistice were sufficiently rigorous to deprive Germany of the ability to continue the war, and they were so made.

Actually, though the German armies had been beaten, the Allied armies were in no position to administer a *coup de grâce* before winter put an end to serious hostilities. The advance of November 1-11 had strained their logistical

support systems to the breaking point. Despite concentrated efforts to repair and operate the railroads, supply railheads lagged behind the troops by 50 to 100 miles. Motor transport had to be used to haul supplies for these intervening distances over roads strewn with mine craters and blown bridges. Under such conditions vehicles broke down in large numbers. Foch had urged his commanders to make final efforts to destroy the retreating Germans, and Rawlinson, Debeney, and Pershing had organized pursuit forces. It is unlikely that any but small pursuit columns could have pressed forward on November 11, and these could have had only minor local effects in a withdrawal of such magnitude. If the Germans could prevent the collapse of the home front and the disintegration of their armies, there was little to prevent them from establishing a position behind the Meuse. In this case the war would have continued into 1919.

**Occupation of Germany.**—The Allies' armies paused on the armistice line for almost six days, ostensibly to allow the Germans time to begin an orderly withdrawal, but also to permit the solution of their own logistical problems. Early on November 17, the movement toward Germany began. The advance was conducted slowly and without enemy interference; only about one fourth of the Allied armies participated. Nevertheless, the general advance was almost halted in early December because supply trains had fallen far behind schedule. In addition to supplying the troops, it was now necessary to provide food for the millions of civilians in the liberated areas, who were on the verge of starvation. Moreover, the Germans released large numbers of prisoners as they withdrew, and these also had to be cared for.

On December 1, the Allied armies marched into Germany proper. Later that month, in accordance with the armistice terms, bridgeheads with a radius of 30 kilometers were established east of the Rhine around Cologne (occupied by the British), Coblenz (occupied by the Americans), and Mainz (occupied by the French). Subsequently the occupation forces were reduced despite Foch's protests. The Americans withdrew the last of their forces in January 1923; the British, in December 1929; and the French and Belgians, in June 1930.

#### GENERAL COMMENTARY

**Defeat of the German Army.**—When it became clear to the German military leaders that victory was no longer possible, they made every effort to escape the blame. No military leader participated in the armistice discussions. Though several admitted defeat to Allied leaders, the situation was portrayed differently to the German people. The theme adopted was that the war had been terminated to prevent further bloodshed and to raise the blockade so that the sufferings of women and children might be alleviated. Returning troops were received as conquering heroes and marched in holiday fashion through gaily decorated streets. When this myth began to be exploded, the German Army accused the home front, charging that its disloyalty and lack of support had caused the catastrophe. Ludendorff heard the phrase "stabbed in the back" and took it as his slogan. Later, Adolf Hitler was to adopt this theme in his exhortations to his Nazi followers. Nevertheless, the facts prove without question that the German

Army had been decisively defeated in 1918.

**American Participation.**—The importance of American participation in the war has often been exaggerated in the United States and minimized in Britain and France. At the time of the armistice there were more American troops in France than British troops, and they held a wider front. The American Army was still growing rapidly, and munitions production in the United States was reaching great heights. If the war had lasted until 1919, American troops would undoubtedly have struck the principal blows. While the United States can scarcely claim to have played the major role in the war, it may fairly be said that it could not have been won without American aid.

To participate effectively in the 1918 battles, the American Army required substantial support from its allies. A little more than half of the 2 million American troops shipped to France were transported in British vessels. Divisions arriving overseas before July 1, 1918, had to be equipped with the French automatic rifle and machine gun; those arriving thereafter had the new American Browning automatic rifle and machine gun, considered the best in the world at the time. Almost complete reliance had to be placed on the French for artillery: of the 2,250 artillery pieces used by the Americans in action, only about 100 were of American manufacture. On the advice of her allies, the United States concentrated on producing aircraft engines and observation-bomber planes. The 12-cylinder Liberty engine was developed and put into mass production. It was a superior engine, in great demand by the British and French, and constituted the greatest single American contribution to World War I aviation. By the end of the war, 45 American squadrons were operating at the front, but only about a fourth of them were equipped with American-built aircraft. American battle casualties during their brief role totaled 257,404—a very small number compared with the millions suffered by each of the other Allies during four years of bitter war.

**Developments in Warfare.**—World War I saw an increasing tendency toward the subordination of man to the machine. The growing importance of armament meant that a nation's industries exerted a decisive influence on its military operations. The bravest and most skillful fighting man, if improperly armed, might find himself helpless in combat. Logistics was transformed from a relatively simple business to a vast field of endeavor equal in complexity and importance to the control of operations. The proportion of noncombatant soldiers needed for the great logistical machines would have astounded Frederick the Great or Napoleon, though it did not approximate the proportion that was to be required in World War II.

The introduction of new methods, based upon the design and production of new equipment, was an outstanding feature of the war of 1914–1918. Except for the atomic bomb, almost every major development of World War II was foreshadowed in World War I. The tactical effect of the increased power of the machine gun and the modern artillery piece gave an ascendancy to the defense that baffled commanders on both sides for a long time.

The tank was undoubtedly the war's most remarkable development in the field of ground combat. Despite its slowness, limited operational

radius, and mechanical unreliability, it achieved some spectacular results in 1918; and even the brilliant Ludendorff was unable to find any adequate means of coping with it.

The airplane became an important weapon. Though the results attained by airpower during the war were hardly decisive, its potential was clearly demonstrated. By war's end strategic bombing had passed its infancy. German dirigibles and aircraft had bombed London, and British aircraft had frequently bombed Rhineland towns. Had the war lasted another week, British bombers would have attempted to bomb Berlin with one-ton bombs.

Gas warfare was employed on a large scale by both sides—initially, with serious effects. Countermeasures were promptly developed, however, and poison gas became a harassing rather than a decisive weapon.

The warring nations undertook psychological warfare on a systematic basis. The Germans harassed Paris with their long-range gun, and propaganda "hate" campaigns and subversive leaflets were used by both sides. Many of these efforts were amateurish by later standards, but they had considerable effect.

Throughout the war the development of battle tactics centered on the basic problem of breaking through a strong defensive position without prohibitive casualties and such loss of time as to make the breakthrough useless. What was accomplished by the capture of a trench line if it took so long that the defender had time to construct another a mile or so in the rear? In his first three drives of 1918, Ludendorff solved the initial breakthrough problem by achieving surprise and by creating a highly efficient body of troops. He gained great local successes, but he could not win a strategic decision because he had no powerful, highly mobile force capable of extended operations to exploit a tactical breakthrough. The Allies, however, were never able to force tactical breakthroughs comparable with those achieved by Ludendorff.

In a military sense the net result of World War I was that the Allies became convinced of the superiority of the defense and made their future plans and preparations accordingly; the Germans, having been frustrated by the lack of a strategic exploiting force, sought ways to build one. They found an answer in the tank-airplane team, the heart of the blitzkrieg, which in 1940 achieved in three weeks what the Germans could not do in the four years of World War I.

See also separate articles on the major battle sites; biographies of the leading generals; section 15. *Diplomatic History of the War*; ARMY—*World War I*; ARTILLERY—*World War I*; INFANTRY—*World War I*; MACHINE GUN; TACTICS—*Historical Developments*; TANK—*World War I Tanks*.

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## 8. Eastern Front

Russian and German strategy and tactics on the eastern front were determined largely by the terrain. In the middle of the line was the Polish salient, at this time a part of Russia, comprising an area 230 miles long and 210 miles wide and leading directly into Germany. On the broad Vistula River, which crossed the salient, was

the fortress city of Warsaw. Warsaw had important defensive value, but it could also serve as a base for a Russian offensive westward into the rich mining and industrial area of Silesia.

Russia could not make a direct advance against Silesia and Berlin, located only 180 miles from the western extremity of the salient, without first safeguarding the flanks of East Prussia to the north and Galicia to the south. If the Germans in East Prussia and the Austrians in Galicia launched converging attacks across the flat land against Brest-Litovsk (now Brest) at the center of the salient, Russian forces west of the Vistula could be cut off. To defend themselves against such attacks, the Russians built a series of fortresses along the Neman and Narew rivers and at Lublin and Kholm (now Chełm). No Russian troops were stationed in the area west of Warsaw, which was kept without railroads and roads in order to prevent a rapid German advance.

To defend East Prussia the Germans constructed fortifications on the upper Vistula and a forward line in the lake district east of Allenstein (now Olsztyn), while in Galicia the Austrians built a fortified defensive barrier along the Carpathian Mountains centering on Lemberg (now Lvov) and running from Kraków to the Rumanian border. Thus the Polish salient was hemmed in and threatened from both north and south. Russia proper was divided from the salient by the Pripet Marshes, a region of swamps, forests, and few roads. To the north, south, and east stretched vast areas that could swallow whole armies.

Railways played an important role in the strategy of the eastern front. Germany had 17 lines leading to the Russian frontier, with a capacity of 500 troop trains daily, enabling her to concentrate a vast force on the border within a few days of a declaration of war. Piercing the Carpathians were 7 Austrian rail lines, permitting a flow of 250 trains daily from Hungary into Galicia. Both the German and Austrian railway systems also had numerous spurs branching off from the trunklines and running parallel to the frontiers. These facilitated rapid deployment and redeployment to repel attacks or to mount offensives. On the Russian side 6 trunklines, several of which were double tracked, radiated from Warsaw to the interior. All the military strength of the Russian Empire could be drawn up along the lines passing through Kiev, Moscow, and St. Petersburg (renamed Petrograd in 1914), but there were few spur lines. The relative lack of north-south lines prevented the Russians from rapidly shifting men along the front to mount surprise attacks or to counter German tactics. These shortcomings in railway transportation (and in the road network) later handicapped the Germans as they penetrated Russia east of the Polish salient.

War Plans.—The initial events on the eastern front were dominated by German strategy in the west. Germany had long prepared for a war on two fronts. In 1890, Field Marshal Count Helmuth von Moltke had devised a plan to defend the western front and throw Germany's main strength against Russia before concentrating on the defeat of France. This strategy was subsequently reversed by Count Alfred von Schlieffen. According to the celebrated Schlieffen Plan, Germany's entire strength was to be directed against France, leaving virtually no forces in the east.

The French armies were to be captured or destroyed within six weeks, and the troops then shifted to the eastern front for a full-scale drive against Russia.

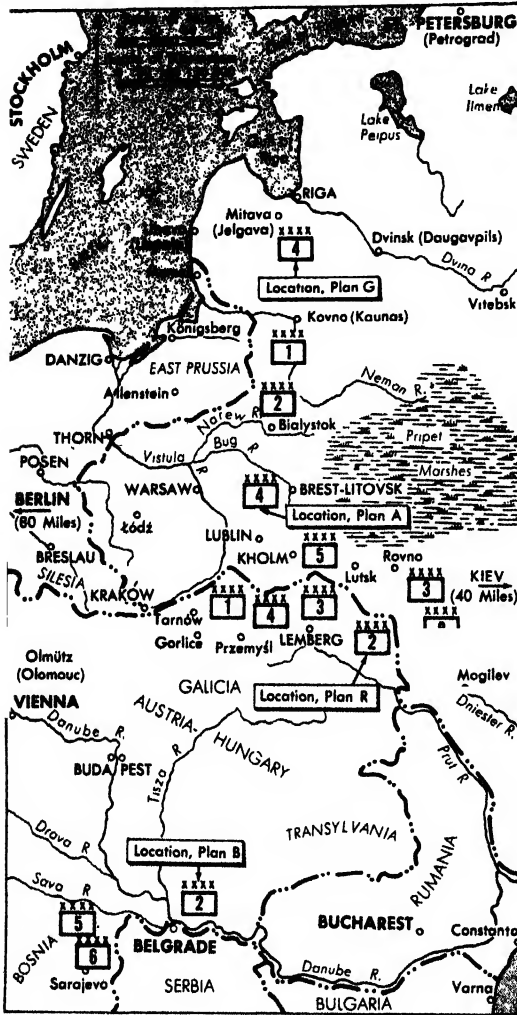
This plan assumed that Russian mobilization would be slow, and that it would therefore be safe initially to leave German territory in the

not assisted by Germany, the net effect of the Schlieffen Plan would be to give Russia complete freedom of action to occupy East Prussia and Galicia and march toward Berlin. For these reasons, Moltke decided to station an army in East Prussia and support it with strong garrisons at Germany's eastern fortresses. As will be seen, Moltke's modifications of the Schlieffen Plan played a key role in the repulse of the initial Russian offensive and in the German victory in the campaign around Tannenberg (now St. Petersburg).

Austria-Hungary and Russia each had two war plans. One Austrian plan assumed a war with Serbia alone, which would be invaded by three armies, while the other three Austrian armies guarded the Russian front in Galicia. The second plan assumed a war with both Serbia and Russia. In this case, four armies would be thrown into battle against Russia, and two would invade Serbia. Of the Russian plans, one was wholly defensive and assumed that Germany would make her first major effort in the east. The army groups in the north and south would retreat eastward until a counteroffensive could be organized. The second plan, which was actually effected, was offensive. It envisaged the main German attack against France and provided for Russian drives against East Prussia and Galicia in order to safeguard both flanks of the Polish salient in preparation for an invasion of Silesia. When war was declared in August 1914, the French, fearing an all-out German drive in the west, urged an early Russian offensive to divert German forces to the east. Much to their regret, the Russians succumbed to their ally's insistence.

**Tannenberg Campaign.**—Russian mobilization proceeded rapidly after the outbreak of war and was accompanied by great enthusiasm. The people considered the struggle a defensive war against German imperialists, who had long threatened Russia and exploited her economically. By mid-August the commander in chief, Grand Duke Nicholas, and the chief of staff, Gen. Nicholas Yanushkevich, had nearly 2 million men on the front line. Although this was only a third of the potential fighting force, and although logistical support for an offensive was lacking, the Russians heeded the pleas of their French ally and ordered converging attacks to start on August 13 from the east and southeast against East Prussia. Gen. Paul Rennenkampf's First Army and Gen. Alexander Samsonov's Second Army, both under the over-all command of Gen. Ivan Zhilinsky at Warsaw, immediately moved their troops into advance positions for the attack. Rennenkampf crossed the border on August 17, five days before Samsonov was scheduled to do so. The plan was to draw German forces north and east, enabling Samsonov's army to envelop their rear. This strategy failed because of the lack of adequate information about German troop dispositions, faulty liaison, and the fact that Rennenkampf did not carry out Zhilinsky's orders to weight his north flank so as to drive the German garrison from Königsberg (now Kaliningrad).

At his headquarters in Allenstein the German eastern front commander, Col. Gen. Max von Prittwitz, ordered three corps to the Angerapp (Węgorz) River area, to guard against invasion from the east, and his fourth corps to the Tannenberg area, to guard the southern border.



**WAR PLANS; EASTERN FRONT.** Germany's plan provided for its Eighth Army to hold the Russians until France had been defeated; then full German power would be turned against Russia. Russia's plans were based on two contingencies: Plan G, an offensive plan, if Germany's main effort was directed against France; and Plan A, a defensive plan, if the effort was directed against Russia. The only difference in troop dispositions was the location of the Fourth Army. Similarly, Austria-Hungary provided for war against Serbia alone (Plan B) and for war against both Russia and Serbia (Plan R).

east undefended. By 1913, however, it was clear that this premise was no longer valid, for Russia was enlarging and improving her army and building military railways. Col. Gen. Helmuth von Moltke, nephew of the field marshal, therefore modified the Schlieffen Plan. He realized that Russia was bound by treaty to take the part of France and would mobilize rapidly from the first sign of hostilities. Since Austria-Hungary would remain on the defensive if she were



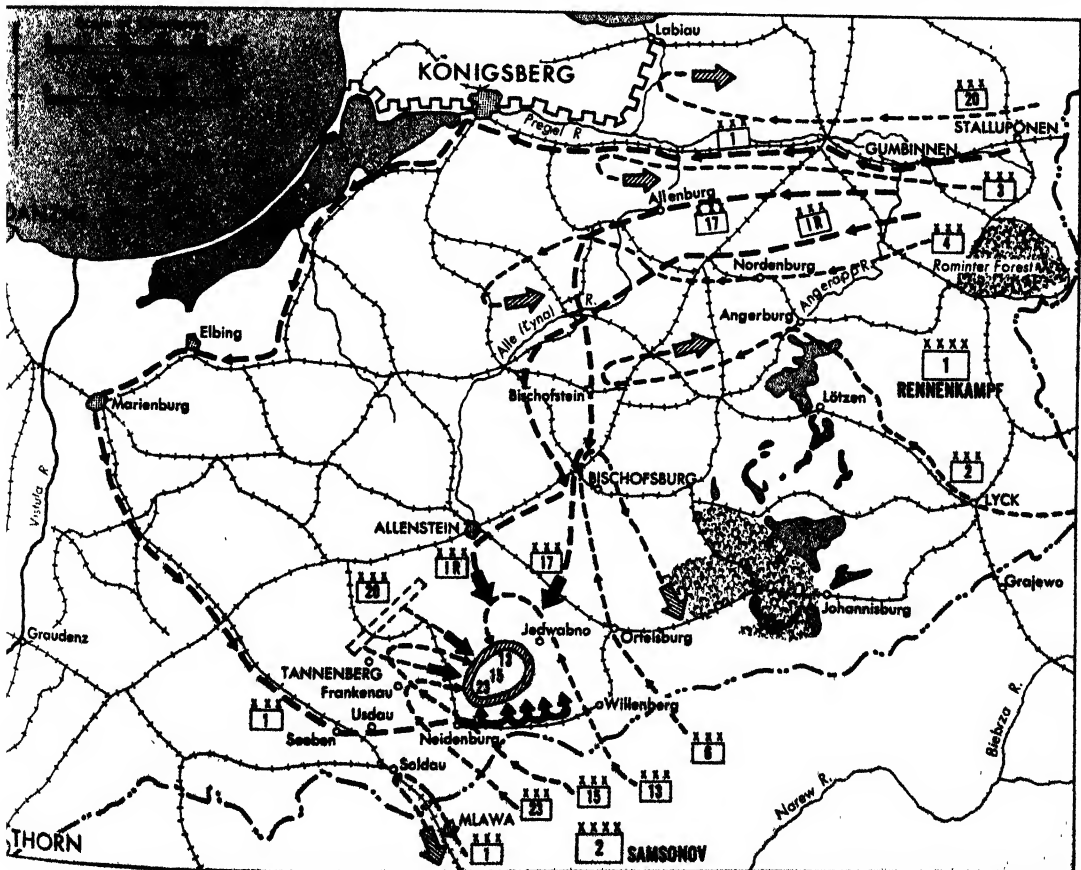
Although he was authorized by the high command to withdraw to the Vistula if necessary, he knew that he was expected to use the terrain and railroads to organize a defense against anticipated successive Russian blows. By means of spies and intercepted radio messages, which the Russians habitually sent uncoded, Prittwitz had obtained information concerning Zhilinsky's battle orders. What he did not know was that the headstrong commander of his 1st Corps, Gen. Hermann von François, had moved forward independently to Stallupönen (now Nesterov) on the border, where he was prepared to fight to prevent Russian violation of Prussia's "sacred soil." When a Russian corps approached, François counterattacked, inflicting heavy casualties on the invaders. Tactically, his action was sound, but it upset Prittwitz' carefully planned strategy. Time was important to the German commander, for he had only five days to defeat Rennenkampf before he would have to turn his armies south to stop Samsonov's anticipated attack. Prittwitz therefore planned to lure Rennenkampf westward into a decisive battle on the Angerapp River. François' counterattack delayed the Russian advance to the contemplated major battlefield.

Fortunately for the Germans, Rennenkampf did not appreciate the danger to his forces. He continued his advance for two days, approaching

but not reaching the Angerapp. By this time, François had consolidated his forces at their designated position around Gumbinnen (now Gusev), but he urged Prittwitz to order an immediate counteroffensive. Over the objections of his brilliant operations officer, Lt. Col. (later Maj. Gen.) Max Hoffmann, who wanted time to bring up two corps entrenched west of the river, Prittwitz gave in and ordered a full-scale attack for August 20.

As Hoffmann feared, the German attack was made piecemeal and achieved little success. Along the greater part of the front the German troops were repulsed. The result was a stalemate, but Prittwitz needed a decisive victory. He had to make up his mind whether to resume the attack or to withdraw toward the Vistula. Later on August 20, news was received at his headquarters in Allenstein that Samsonov's Second Army had already entered East Prussia. Prittwitz thereupon telephoned Moltke that he would withdraw to the Vistula, but that he would need reinforcements to hold the Russians even there. Moltke's immediate reaction was to relieve Prittwitz of his command, and by August 23 his successor, Gen. (later Field Marshal) Paul von Hindenburg, called from retirement, reached the front with his chief of staff, Maj. Gen. Erich F. W. Ludendorff, who had already distinguished himself in

**TANNENBERG CAMPAIGN (Aug. 17-29, 1914).** Germany having made its main effort against France, Russia immediately launched its offensive Plan A against both East Prussia and Austria in accordance with its agreement with the French, although its forces were only partially mobilized. The First Army advanced from the east and engaged elements of the German Eighth Army at Stallupönen and Gumbinnen without material results. Meanwhile, the Second Army entered East Prussia from the south to trap the German Eighth Army. In a brilliant operation the Germans shifted front to engage the Second Army, encircled three Russian corps, and virtually destroyed the Second Army. The Russian First Army, which had made a halfhearted effort to assist the Second, then turned about and withdrew.



the fighting on the western front.

While Hindenburg and Ludendorff were to be credited with reversing the tide of battle and achieving a German victory at Tannenberg, Hoffmann actually developed a new strategic plan before they arrived at the front. Between August 20 and 23, he moved a division and a corps from the front against Rennenkampf to face Samsonov's advancing Second Army in the south, which was threatening to cut off the German troops by a drive northwestward to the Gulf of Danzig. Two additional German corps were moving westward and were ready to turn south if Rennenkampf did not press his advance.

Hoffmann's plan was approved by Hindenburg and Ludendorff. The German forces were now concentrated against Samsonov's slow-moving offensive, with only a cavalry division and a brigade left in the north to delay Rennenkampf. The shift was a daring maneuver, but the Germans could well afford it. Inadequate railroads and roads, virtually nonexistent logistical support, and dissension between Zhilinsky and Samsonov slowed the Russian advance. These difficulties, as well as the day-to-day tactics of the Russians, were well known to the Germans, because they were broadcast in plain language by Zhilinsky's headquarters and by Rennenkampf and Samsonov in the field. The lack of trained code and communications personnel proved a major handicap to the Russians.

On August 24, the middle of Samsonov's line met entrenched German opposition at Frankenau, and heavy fighting broke out that lasted all day. Since Samsonov still thought the Germans were in flight to the west, however, it was announced on his radio that August 25 would be a day of rest.

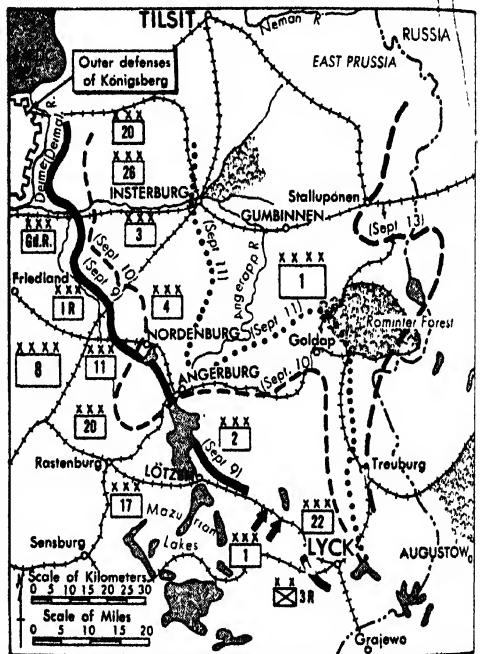
The Germans did not rest. Assured that they would have time to concentrate their strength against Samsonov before Rennenkampf was able to intervene, Hindenburg, Ludendorff, and Hoffmann set their trap. The 20th Corps at Frankenau was withdrawn northwestward and dug in at Tannenberg. To the south garrisons transported from Königsberg and the Vistula prepared a breakthrough at Usdau (now Uzdowa); and at Bischofsstein (now Bisztynek), to the northeast of Allenstein, German forces diverted from the front against Rennenkampf were detoured to strike a decisive blow at the Russian rear. On August 26, François' 1st Corps, which had been moved south, took Seeben. On the same day, the Russian 6th Corps was routed by the German 17th and 1st Reserve Corps just north of Bischofsburg (now Biskupiec), and the envelopment of Samsonov's northern flank began. The Russian 6th Corps escaped across the border south of Ortelsburg (now Szczecyno), as did their 1st Corps via Mława; but the three central corps (13th, 15th, and 23d) were threatened with encirclement by the four German corps.

Samsonov does not seem to have realized the full measure of the disaster until the morning of August 29, when the Russian retreat had become general. During the day the Germans forced the three fleeing Russian corps into a pocket that constantly grew smaller. On August 30 and 31, the Russians tried to break through François' lines, but they succeeded only in retaking Neidenburg (now Nidzica), which they had to evacuate again the following day. All escape routes were now tightly sealed. The Germans captured 125,000 men and 500 guns in the Tannenberg

pocket, whereas their own losses for the whole campaign totaled between 10,000 and 15,000 men. There are no accurate figures on the Russians killed and wounded, but the losses were staggering. Defeated and despondent, Samsonov committed suicide.

The Tannenberg campaign thus ended in a great German victory. Rennenkampf's army in the north was still intact, however, and Hindenburg, Ludendorff, and Hoffmann now made plans to dispose of these remaining Russian invaders.

**Masurian Lakes Campaign.**—Rennenkampf had been ordered by Zhilinsky to come to the aid of the Second Army, but his troops did not have time to reach the battlefield. On August 30, the First Army commander learned of the catastrophe at Tannenberg and turned his own forces back. With his right flank on the Baltic Sea, his left flank extending to the Masurian Lakes, and a corps protecting the Lötzen (now Giżycko) Gap, Rennenkampf felt secure against a German offensive.



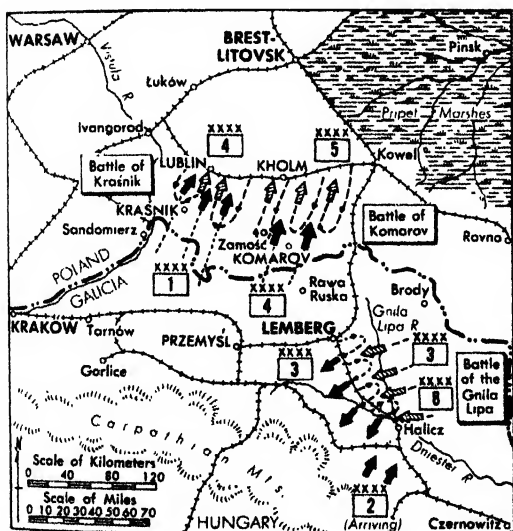
**MASURIAN LAKES CAMPAIGN (Sept. 9-14, 1914).** After Tannenberg, the German Eighth Army, now augmented by reinforcements from the western front, concentrated its efforts against the Russian First Army. A successful German envelopment on the south flank made the position of the Russians untenable and forced them to withdraw. To cover the withdrawal, they launched a strong counterattack in the center, which deceived the Germans and allowed sizable forces to escape. Nonetheless, the Russian First Army was decisively defeated and expelled from East Prussia with large losses.

Again the Russians miscalculated. Zhilinsky reinforced the remnants of Samsonov's army in anticipation of a German offensive against Warsaw. Although the Austrians, who were in difficulties in their Galician campaign, urged the Germans to attack Warsaw, Hindenburg and his staff considered Rennenkampf's force their first objective. On September 9 and 10, the Germans secured the southern flank by Lyck (now Elk) and Augustów. An attempt to break through the Lötzen Gap was repulsed by Rennenkampf, but he had to commit all of his reserves to do so.

Then the German 1st Corps forced the Russian 2d Corps to retreat, clearing the route toward Gumbinnen. Fearing another Tannenberg, Rennenkampf ordered his army to withdraw. Meanwhile, to protect his retreat, he simultaneously launched a counterattack between Nordenburg (now Krylovo) and Angerburg (now Węgorzewo). The losses suffered by the German corps facing this attack alarmed Ludendorff, who curtailed the advance of his right flank. The enveloping movement was therefore not so deep as he had planned originally, and Rennenkampf was able to save most of his army by forced marches of as much as 55 miles in 50 hours. Nevertheless, the Russian First Army sustained losses estimated as high as 145,000 men. German losses were in the neighborhood of 10,000 men.

Thus in three weeks, Hindenburg, Ludendorff, and Hoffmann had cleared East Prussia of the enemy. Zhilinsky, who complained to headquarters of Rennenkampf's deficiencies, was himself relieved of his command on September 17 in favor of Gen. Nicholas Russki, who had scored successes on the southern flank of the Polish salient in Galicia.

**Galician and Polish Campaigns.**—While Zhilinsky's forces were being driven from East Prussia, other Russian forces under Gen. Nicholas Ivanov fought the Austrians under Field Marshal Count Franz Conrad von Hötzendorf in Galicia.



**GALICIAN BATTLES** (Battles of Krasnik, Komarow, and Gnila Lipa; Aug. 23-Sept. 1, 1914). The Austrian and Russian offensives collided along the Galician border. On the left the Austrian First and Fourth armies drove back the Russian Fourth and Fifth armies in the battles of Krasnik and Komarow. On the right the Austrian Third Army advanced to the Gnila Lipa where it was forced to retreat by the Russian Third and Eighth armies.

Conrad von Hötzendorf's indecision jeopardized the Austrian position from the first days of the war. Initially, he committed three of his six armies against Serbia. Subsequently he withdrew part of one army, but it arrived too late to affect the outcome of the first Galician battles.

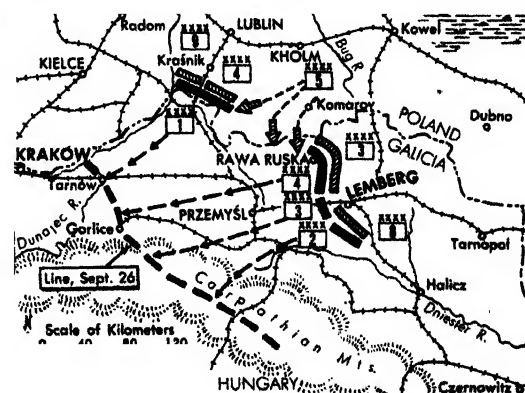
To make matters worse, Conrad von Hötzendorf decided that the Russians would probably concentrate their forces in the Lublin-Kholm area, and he deployed two armies in that direc-



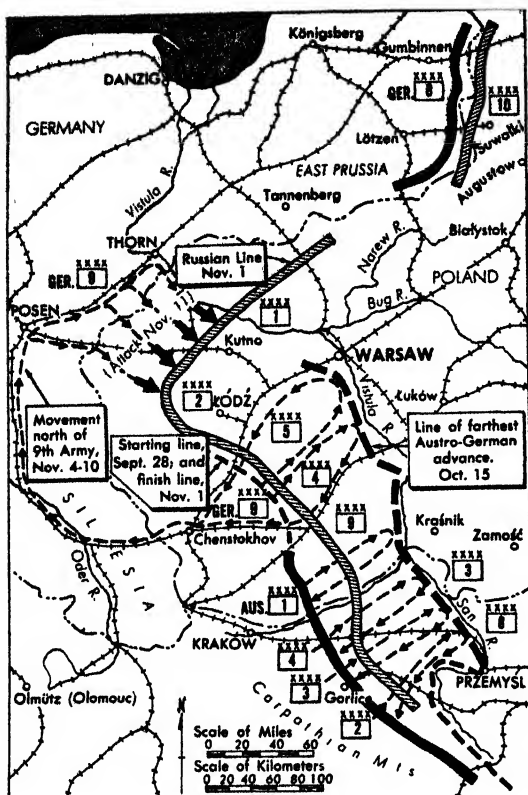
The Bettmann Archive

Russians enter Lemberg (now Lvov) on Sept. 3, 1914, after routing the Austrians in the Battle of the Gnila Lipa.

tion, retaining only one for the defensive line southward from Lemberg. Ivanov also misjudged his enemy. Anticipating the major Austrian attack from Lemberg, he directed his own main attack in that area, while a weaker force moved down from the north through Krasnik, Zamość, and Komarow. Reconnaissance on both sides was poor. On August 23, the Russian Fourth and Austrian First armies collided unexpectedly at Krasnik. The Russians were forced back by August 25, and Conrad von Hötzendorf, prematurely elated, ordered his troops to attack at Zamość and Komarow, drawing reinforcements from the Lemberg front for the purpose. The Austrians scored limited gains in the Battle of Komarow (August 26-September 1), but they were wholly unprepared for the major Russian thrust at Lemberg, which also was launched on August 26. In the ensuing Battle of the Gnila Lipa (now Gnilya Lipa), the Austrians were routed, and Conrad von Hötzendorf, failing to see that he might still save the situation by ordering an enveloping drive on the Russian flank and possibly scoring a stunning victory against Ivanov's main force, ordered instead a general retreat. By September 8, the Austrian First Army had fallen back to the south of Krasnik, while the Second,



**GALICIAN BATTLES** (Battle of Rawa Ruska, Sept. 5-11, 1914). The Austrians sent their Fourth and Second armies (the latter rushed from the Serbian front) to assist their stricken Third Army. In its movement the Fourth Army left a wide gap in the line in the Komarow area through which the Russian Fifth Army poured. Threatened with encirclement from the north, the Austrians withdrew to the line of the Carpathian Mountains, leaving 100,000 men in the fortress of Przemyśl, all of whom were lost when the fortress subsequently surrendered to the Russians.



**GERMAN NINTH ARMY IN POLAND (Sept. 28–Nov. 24, 1914).** The Germans formed the Ninth Army in southern Poland to bolster the Austrians after their defeats in the Galician battles. The Russians, meanwhile, prepared to launch a huge offensive into Germany. To forestall this offensive, the Ninth Army attacked toward Warsaw, supported by the Austrian armies on the right. The attack was turned back at the gates of Warsaw by superior Russian forces, and the Germans and Austrians withdrew to their original starting line. The Ninth Army then shifted rapidly to the Posen-Thorn area, drove between the Russian First and Second armies, and almost succeeded in enveloping the Second Army in the Battle of Łódź. These operations of the Ninth Army definitely stopped the proposed Russian invasion of Germany.

Third, and Fourth armies were endeavoring to consolidate their hold on the Lemberg front. This development opened a huge gap through which the Russian Fifth Army poured. Tired and disorganized from days of entraining and detraining, the Austrians gave ground. This engagement is known as the Battle of Rawa Ruska (now Rawa-Russkaya). The battlelines on September 26 show that the Austrians had withdrawn 100 miles; they had suffered 350,000 casualties.

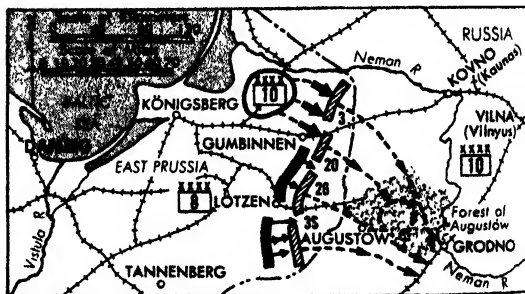
Ivanov scored a decisive victory in Galicia. The way was now open for the Russian forces to enter Silesia unless the Germans could stop them. Following their defeat in the First Battle of the Marne, the Germans could not afford to transfer troops from the western front, however, and Hindenburg was compelled to rush troops from East Prussia to help the Austrians. On September 28, a newly constituted German Ninth Army detrained at Chęstochowa (now Częstochowa) for this purpose.

The imminent Russian threat to Kraków made immediate action imperative. Hindenburg's goal was to seize crossings on the lower Vistula preparatory to an advance on Warsaw. The Ninth

Army reached the river on October 9. Intercepted Russian radio messages gave Hindenburg a clear picture of Ivanov's strategic plan to encircle the German left flank, but the Germans continued on their course, and by mid-October they were within 12 miles of Warsaw, the high-water mark of their offensive. Then Russian pressure, combined with Austrian weakness on the southern flank, forced them to withdraw, and by November 1 they had fallen back to the starting line of September 28.

Meanwhile, the French again besought their Russian allies to invade Silesia via Warsaw and Posen (now Poznań) in order to relieve German pressure on the western front. Since Silesia's mineral resources and industrial plant were vital to their war effort, the Germans could be expected to withdraw troops from the west to combat an all-out Russian offensive. The Russians acquiesced, but Hindenburg blocked their plan for a drive straight through the Posen-Thorn (now Toruń) area and was able to move the Ninth Army into position in time to parry the expected Russian blow with an offensive of his own. On November 11, the German forces under Gen. (later Field Marshal) August von Mackensen's command attacked north of Łódź, in four days they advanced 50 miles. Nevertheless, the Russians started their Silesian offensive on November 14, not realizing until November 16 that their Second Army was being encircled in the Łódź area. They managed to extricate their troops from Hindenburg's trap, but the cost was great; Łódź fell to the Germans, and the Russian drive into Silesia had to be abandoned.

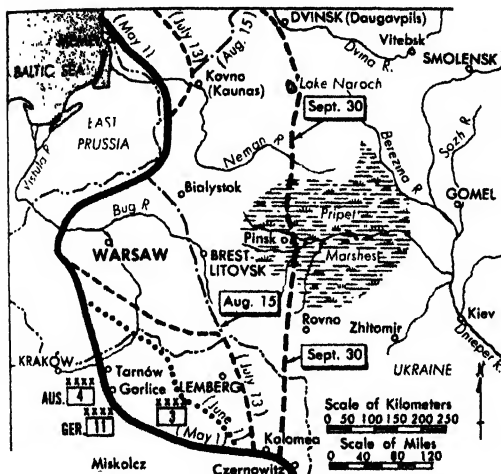
**Operations in 1915.—Winter Battle of Masuria.**—In January 1915, Hindenburg and Ludendorff persuaded Emperor William II that an effort should be made to knock Russia out of the



**WINTER BATTLE OF MASURIA (Feb. 7–21, 1915).** The plan of the Central Powers for 1915 was to drive Russia from the war. It envisioned an offensive from East Prussia by the Germans and a simultaneous advance by the Austrians in the Carpathians. The Germans secretly concentrated their Tenth Army on the Neman River, attacked, and overwhelmed the Russians. The 3d, 26th, and 3d Siberian corps escaped, but the 20th Corps was encircled in the Forest of Augustów, and more than 100,000 prisoners were taken. This was a great tactical victory for the Germans, but the Austrian attack in the south failed, so that the over-all strategic gains were nil.

war. An Austrian offensive on the edge of the Carpathians in February failed, but the German Tenth Army, driving southward from the Neman River, forced a Russian corps to surrender in the Forest of Augustów. Although three other corps escaped, the Russian casualties totaled 200,000 (of these, half were prisoners). The winter Battle of Masuria thus resulted in a major victory for the Germans, but their over-all plan to eliminate Russia from the war did not succeed.

**Gorlice-Tarnów Breakthrough.**—By March 1915, war weariness had set in in Russia. On the home front food shortages in the cities, incapacities of administration, and corruption had created a desire for peace that was voiced by both left and right. On the fighting front the armies were too weak to launch a major offensive; clothing and ammunition were often in short supply. Meanwhile, the Germans were secretly developing an offensive base in the Gorlice-Tarnów area. Infantry and artillery were brought in from the western front to reinforce the Fourth and Eleventh armies for an attack. The offensive was launched on May 2 behind a barrage utilizing 950 artillery pieces. Taken completely by surprise, the Russians fled in panic. A complete breakthrough was scored two days later, and by June 22 the German juggernaut had rolled over Lemberg. Turning north, the Germans took Warsaw on August 4–5 and Brest-Litovsk on August 25. By the beginning of October, German armies had penetrated deep into Russian territory, the front running from just west of Dvinsk (Daugavpils) in the north southward through the Pripet Marshes to Kolmea (now Kolomyia).



**GORLICE-TARNÓW BREAKTHROUGH (May 2–4, 1915).** The critical Russian shortage of weapons and munitions led the Germans to believe that another offensive would eliminate the Russians from the war. The Eleventh Army (from the western front) attacked in conjunction with the Austrian Fourth Army, gained surprise, and practically destroyed the Russian Third Army. Continued German and Austrian attacks compelled the Russians, whose logistical problems were now acute, to withdraw to the line shown.

The Gorlice-Tarnów breakthrough and subsequent campaigns in 1915 cost the Russians 2,000,000 casualties, of whom half were prisoners. Meanwhile, on September 5, Czar Nicholas II assumed command of the Russian armies.

**Operations in 1916.—Winter and Spring.**—Following the losses of the Gorlice-Tarnów breakthrough, the Russians tried to rebuild their armies in preparation for a summer offensive. French entreaties for a diversion at the time of the German Verdun attack in February 1916 once again caused them to act prematurely. In March, the Russians attacked near Lake Naroch, but their drive was soon halted by stiff German resistance and by mud from the spring thaws. The eastern front then remained dormant while both



André Kertész

Mass is celebrated for Austrian officers in August 1915 at Lonia, Galicia, during Austro-German drive eastward.

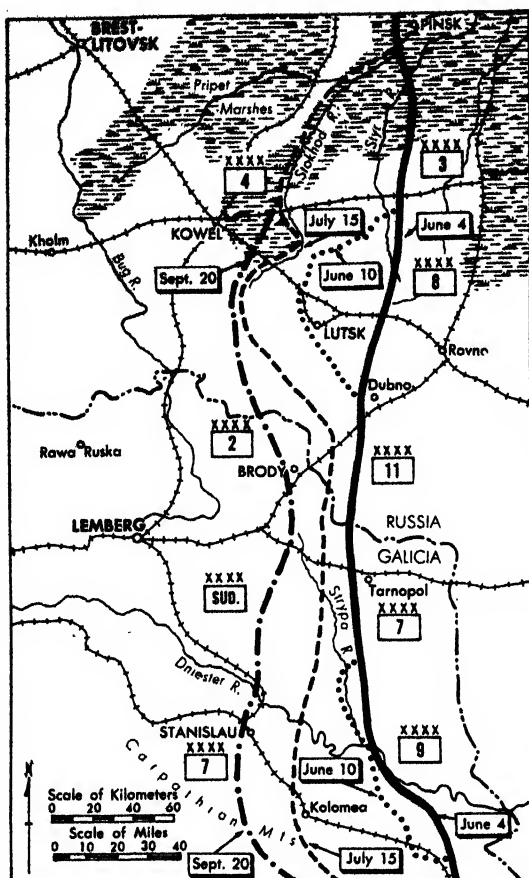
sides got ready for the summer campaigns. The czar, no strategic genius, planned a July offensive north and south of the Pripet Marshes with the capture of Vilna (Vilnyus) by the West Army Group as its first goal. In May, however, the Austrians launched an attack on the Italian front, and now it was Italy's turn to appeal to Russia for assistance. The czar agreed to create a diversion. The Russian commanders north of the Pripet Marshes felt unprepared to advance the date of the projected summer offensive, but the commander of the Southwest Army Group, Gen. Aleksei Brusilov, volunteered to attack alone, starting on June 4.

**Brusilov's Summer Offensive.**—Alone among high-ranking Russian officers, Brusilov had carefully studied German tactics. He concluded that it would be advantageous to forgo concentrations of superior manpower for the surprise to be gained through a rapid, highly mobile attack prepared in complete secrecy. Once his forces had been drawn into position, and his officers had been carefully briefed, he struck quickly and hard. His efforts were not in vain: the offensive achieved Russia's greatest success of the war.

The Austrian line on the Dniester and Strypa rivers was breached within a week. Brusilov's troops then took Lutsk and threatened the rail junction at Kowel (now Kovel). Again Hindenburg was compelled to come to the aid of the Austrians, but although German reinforcements slowed Brusilov's advance, they were unable to stop it. A recognized military historian, Col. Vincent J. Esposito, has written that the battle "became a race between the excellent German-Austrian lateral communications and the inferior Russian railroads. The Germans won" (*The West Point Atlas of American Wars*, vol. 2, opposite map 36, New York 1959). The battle-lines of September 20 show that Brusilov's offensive had carried the Russians to the Carpathians in the south and along a line running west of Stanislaw (now Stanislaw), Brody, and Pinsk. The drive had exacted a tremendous toll, however, and it collapsed because of the exhaustion of the troops and the lack of ammunition.

The Brusilov offensive had raised great hopes in Russia, all of which were now dashed, and the groundwork was laid for the revolution. It also had major consequences for the Germans. By weakening their position on the western front and helping to influence Rumania to enter the war on the Allied side, the offensive contributed to the eventual German defeat.





**BRUSILOV OFFENSIVE (June 4-Sept. 20, 1916).** Gen. Aleksei Brusilov launched a gigantic offensive to relieve Austrian pressure on the Italian front. The attack surprised the Austrians and gained striking initial successes. Through use of their superior rail net, however, the Germans shifted troops from the north and halted the Russian offensive. Losses totaled more than 1,000,000 men on each side. The strategic results of the Brusilov offensive were far reaching: Austrian losses were so great as to preclude further offensive action, and the Austrian offensive in Italy had to be halted; 15 German divisions had to be transferred from the Verdun front to the eastern front; Rumania entered the war on the side of the Allies; and Russia's huge losses started her on the road to revolution.

**Revolution and Military Collapse in Russia.**—When the Brusilov offensive ended without success and with huge losses, morale in the Russian Army quickly deteriorated. Ammunition supplies had run out, many soldiers lacked shoes and sufficient clothing, adequate food supplies had long ceased reaching the front, and to the soldiers it seemed that the leaders callously ignored the loss of lives. The czar refused to countenance the governmental reforms demanded by the left and alienated what little support remained for his rule among the liberal middle class. The slogan "Peace and Bread" reflected an overwhelming Russian desire. Rebellion broke out in Petrograd on March 12, 1917, and three days later the czar was forced to abdicate. A liberal provisional government headed by the socialist Alexander Kerenski was swept into office, but real power in the capital was exercised by the Petrograd Soviet of Workers' and Soldiers' Deputies.

At first, the overthrow of autocracy seemed a great advantage for the Allies, for Russia ap-

peared wholeheartedly to have joined the democracies of the west. But appearances were deceptive. The Petrograd Soviet's Order No. 1, designed to create a more democratic army, in fact caused the dismissal of the best and most experienced officers, and with the abolishment of capital punishment soldiers deserted by the thousands. The Germans realized that Russian demoralization would be exacerbated by inaction. No offensive was launched, but in April the high command brought Vladimir Lenin and his Bolshevik lieutenants east by sealed train from their exile in Switzerland. Hindenburg and Ludendorff expected that increased Bolshevik propaganda, the lack of discipline in the army, and the growing desire for peace in Russia would soon leave the Germans virtually unopposed on the eastern front.

Kerenski's undoing was that he tried to uphold Russia's obligations to her allies. The remaining Russian commanders—Russki, Brusilov, Lavr Kornilov, Vasili Gurko—insisted that the new government must not heed the popular desire for a separate peace with Germany. Kerenski gave in and authorized Brusilov to attempt a new offensive against Lemberg. On July 1, Brusilov led a force composed chiefly of Finns, Siberians, and Poles (the most reliable elements left in the Russian Army) against remnants of the collapsing Austrian Army. They registered gains of as much as 30 miles before a German counteroffensive sent them reeling back to the Galician frontier. The attack was a futile effort and the last Russian offensive of the war.

**End of the War on the Eastern Front.**—Hindenburg and Ludendorff calculated that one more successful German offensive would cause the overthrow of the Kerenski government and



U.S. War Dept. General Staff

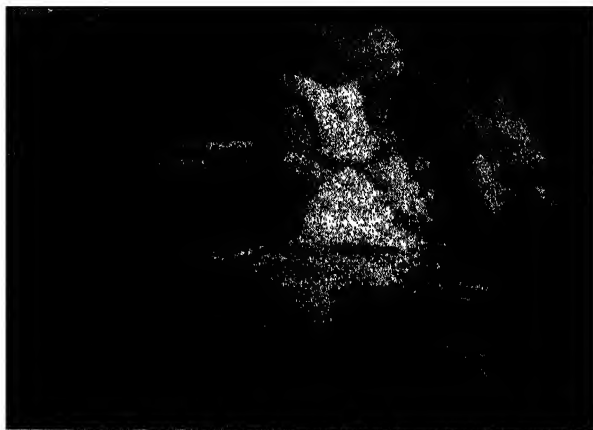
Ex-Czar Nicholas II, who abdicated the Russian throne on March 15, 1917, is shown under guard. With his immediate family, he was executed on July 16, 1918.

remove Russia from the war. On September 1, the German Eighth Army assaulted Riga, capturing the city two days later and driving beyond it. The Kerenski government fell, and on November 6-7 (October 24-25, Old Style), Lenin seized power in Petrograd. The next day the new Soviet government adopted a peace decree. This was interpreted by Leon Trotsky, on November 21, as a request for an armistice. Hostilities on the eastern front were suspended on December 2, and the next day delegates of Russia and the Central Powers met at Brest-Litovsk to arrange terms. The armistice negotiations were succeeded on December 22 by a peace conference.



**COLLAPSE OF RUSSIA (March 1917-March 1918).** After the abdication of Czar Nicholas II on March 15, 1917, the Russian armies rapidly disintegrated. A last desperate attack was made—the Kerenski offensive—in July 1917. It met with some initial success, but the Russians were soon driven back. In September 1917, the Germans attacked the city of Riga to hasten Russian capitulation; on March 3, 1918, the Treaty of Brest-Litovsk was signed, under which the Germans occupied the area shown.

Trotsky, who became the head of the Soviet delegation in January 1918, haggled and played for time, hoping that the Bolshevik Revolution would sweep Germany and keep Russia from having to sign that power's severe peace terms. Pressed hard by the chief German delegate, Gen. Max Hoffmann, he tried an audacious maneuver. On February 10, he announced that Russia refused to sign the German terms and unilaterally declared the state of war to be ended. This amounted to a declaration of "no war—no peace." The reaction of the Germans was furious and immediate. They denounced the armistice, and at dawn on February 18 their troops poured across the lines, meeting no resistance. They captured Dvinsk in the north and Lutsk in the south. The next day, German headquarters received a telegram from Lenin accepting the peace conditions offered at Brest-Litovsk, but the advance continued to Lake Peipus and Narva in the north, where it directly threatened Petrograd. In the south, German troops swept through the Ukraine. Finally, on March 3, a peace treaty was signed



Militärhistorisches Forschungsamt

Fires caused by explosions in Kiev, occupied by the Germans during their drive into the Ukraine in March 1918.

at Brest-Litovsk. By its terms, Germany was to occupy a large expanse of Russian territory. If it had not been superseded by the subsequent armistice on the western front and by the Treaty of Versailles, Russia would have lost a third of her population, a third of her agricultural land, and more than half of her industry.

The war on the eastern front was over, and Russia lay defeated and wracked by poverty and civil war. Victory came too late for the Germans, however, for the long struggle had prevented them from ever concentrating all of their strength in the west.

See also section 15. *Diplomatic History of the War—Termination of the War (Collapse of the Eastern Front)*; separate biographies of the leading generals; *AUSTRIA-HUNGARY—Austria-Hungary During World War I*; *BREST-LITOVSK, TREATIES OF; GERMANY—4. History Since 1850 (World War I and the Weimar Republic, 1914-1933)*; *UNION OF SOVIET SOCIALIST REPUBLICS—16. History of Russia and the USSR*.

GERALD FREUND,  
Author of "Unholy Alliance."

## 9. Italian Front

Italy declared war on Austria-Hungary on May 23, 1915, and began active operations the next day. The initial Italian strategic plan, which had been developed early in April, envisioned operations in conjunction with the Russians, Serbs, and Montenegrins to break into the plains of Hungary and force the collapse of the Austro-Hungarian Empire. At that time the Russians had advanced to the foot of the Carpathian Mountains, deep in Austrian territory. Early in May, however, an Austro-German counterattack drove the Russians back and crumpled their southern front. Now, on May 24, the general situation, which had looked so promising for the Allies a month before, was dark indeed. Stalemated on the western front, frustrated in Gallipoli, and with Russia in serious straits, they were grateful for Italy's decision to join them. With the principal attention of the world focused on the titanic western front, the part played by Italy in the war has generally been underestimated. Some of the bitterest fighting under the most difficult conditions took place on the Austro-Italian front, and events there exerted considerable influence on the conduct of the war as a whole.

The general course of the war on this front

is simply told. Restricted by topographical considerations to offensive action on the single narrow front of the Isonzo River, the Italians launched 11 ferocious attacks there between June 1915 and September 1917. The resulting territorial gains were meager, but the attacks succeeded in so wearing down the Austrians that large German formations had to be rushed to the front to prevent a collapse. Meanwhile, an Austrian offensive from the mountainous Trentino in mid-1916 to relieve the pressure on the Isonzo front had failed. In the autumn of 1917 a combined Austro-German offensive on the Isonzo caught the Italians unprepared and brought on the debacle of Caporetto (now Kobarid). Forced back to the Piave River, the Italians, bolstered by Allied units, held firmly and repulsed all attempts to dislodge them. The sting of Caporetto brought a resurgence to the Italian home front that excited the admiration of the world. Factories hummed, and all hands turned with determination to preparations for the final victory. In the fall of 1918, these efforts culminated in the glorious Battle of Vittorio Veneto, in which the Austrians were eliminated from the war.

**Strategic Considerations.**—Nowhere has terrain exerted a more decisive influence on strategy than on the Austro-Italian front. Unfortunately for the Italians, this influence was for them predominantly adverse. The frontier, 484 miles in length, was divided into three distinct sectors: the Trentino (part of the South Tirol) on the west, the Dolomites and the Carnic Alps in the center, and the line of the Isonzo River on the east. The Trentino, which then belonged to Austria, formed a deep wedge into northern Italy. It was a rough, mountainous area which the Austrians had converted into a veritable fortress. Any major advance in the Trentino would have to be made up the Adige Valley, where it could easily be stopped in the fortified Trento (Trent) defile area or at the Brenner Pass farther north. Even if successful, such an advance would lead to no strategic objective of consequence. The Trentino pointed straight to the heart of northern Italy, and an Austrian offensive there would threaten to cut off Italian troops at the Carnic and Isonzo fronts. The area was detached from Austria proper, however, and it was served by only one railroad, which could not supply forces of the size necessary to ensure success. Furthermore, an excellent rail net enabled the Italians to shift troops rapidly from other fronts to counter an offensive in the Trentino.

The Carnic Alps in the central sector were forbidding. Mountain passes suitable only for Alpine troops were often situated at altitudes of over 6,500 feet. A breakthrough here might lead to the cutting of the rail line from Austria proper to the Trentino, but the great number of Italian Alpine troops needed for such a venture was not available, and the operational season in the mountains was only of a few months' duration.

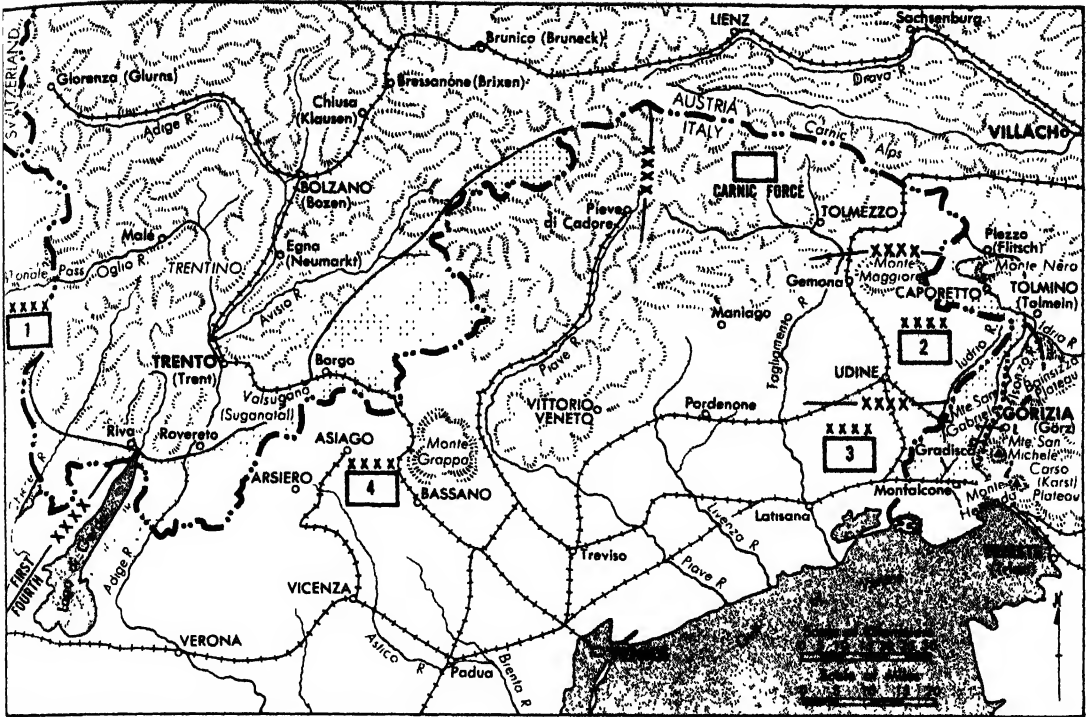
The only area in which a decision could be reached by either side was the Isonzo front, and from the Italian point of view this front was less formidable than the others only by comparison. The Austrians controlled all the crossings of the Isonzo and the dominating mountains and high areas to the east, and any Italian attempt to cross the river was therefore subject to withering artillery and infantry fire. As one analyst described the Italian dilemma, "the river could not be crossed until the mountains had been seized,

and the mountains could not be seized until the river had been crossed." The principal features of the Isonzo front were the strongly fortified Gorizia (Görz) area in the center, the rugged Bainsizza (Bansizza) Plateau to the north, and the rocky, barren Carso (Karst; Kras) Plateau to the south, with its precipitous slopes rising as high as 900 feet above the sea, and dominated by two towering mountains, Monte San Michele and the Hermada. In short, fighting by the Italians along the frontier would be consistently uphill and against strong defenses.

**Initial Operations.**—At the time of Italy's entry into the war the Austrians had joined with the Germans in highly successful operations against the Russians, and for the time being they elected to pursue these operations and to maintain a purely defensive posture on the Italian front. The Austrian chief of staff, Field Marshal Count Franz Conrad von Hötzendorf (generally referred to as Conrad) had assembled 14 divisions on the Italian front. In addition, although Germany and Italy were not then at war, the Germans had provided their *Alpenkorps* (a crack mountain unit of about division strength) for employment in the mountains of the Trentino. The Italian commander, Gen. (later Marshal) Count Luigi Cadorna, had at his disposal 35 divisions. This would seem to indicate a better than two-to-one superiority over the Austrians, but since the training, equipment, and artillery of the Italian troops were not complete and the Austrians occupied extremely strong defensive positions, the combat strength of the two opponents was approximately equal.

On the first day of war, Cadorna launched a general offensive along the entire front. His First Army struck the nose and southeastern face of the Trentino salient as the Fourth Army attacked the northeastern face, hoping to break through to the railroad and cut off the Austrians in the Trentino. The Fourth Army would then advance eastward down the valley of the Drava River, join the Carnic Corps as the latter broke through on its front, and move toward Villach. Meanwhile, the Second Army would capture Caporetto and its environs, and the Third Army would advance to the Isonzo between Gradisca and Montfalcone. It was an ambitious enterprise, but the 23 divisions allotted to the three principal offensive armies were not sufficient to accomplish the many tasks assigned. Nevertheless, by June 16, when the initial operations were halted, significant gains had been made up to the Austrian line of resistance *à outrance*, and the Italian positions for subsequent tactical operations had been greatly improved. "It had become clear, however, that the war on the Austro-Italian front was to be a war of deliberate siege of strong defenses and of bloody attrition. The Italians now paused to complete their mobilization, move additional troops to the front, and prepare for a new drive. As the Italian official account stated ". . . the strengthened barrier which the enemy has prepared with skill and feverish activity against our irruption will require a series of attempts to wrest the strengthened positions, beginning on June 23 with the first battle of the Isonzo."

**First Four Battles of the Isonzo.**—On June 23, 1915, the Italians began the First Battle of the Isonzo, which lasted until July 7. It was followed in rapid succession by the Second Battle (July 18–August 3), the Third (October 18–



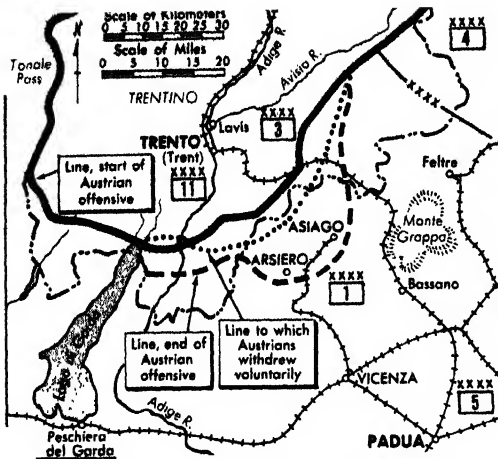
**INITIAL ITALIAN OPERATIONS AND THE BATTLES OF THE ISONZO (May 1915–Sept. 1917).** When Italy entered the war, the Austrians, fully occupied elsewhere, assumed a purely defensive attitude on the Italian front. The Italians immediately launched a general offensive to improve their tactical positions, pending full mobilization. The shaded areas on the map indicate the gains made during this offensive. The nature of the terrain along the Italo-Austrian border was such that the only sector in which the Italians could hope for decisive results was the difficult Isonzo River area, to the east. Eleven offensives (First to Eleventh Battles of the Isonzo) were launched against the Austrians during the period June 1915–September 1917. Territorial gains were meager: the dotted line shows the extent of gains made during the first 4 offensives; the dashed line, the overall gains in the 11 offensives. The net results of these costly battles of attrition were the development of a war weariness in the Italian forces and the wearing down of the Austrians to a state of near collapse.

November 3), and the Fourth (November 10–December 2). These battles were attempts by the Italians to break through the strong Austrian defensive positions from south of Tolmino (Tolmein; now Tolmin) to the sea, the major efforts being made in the Gorizia area and against the Carso Plateau. Lacking heavy artillery, blocked by stubborn defenders in well-prepared positions, and plagued by heavy autumn rains and winter cold, the Italians paid dearly for the small gains they scored. Courage and untold sacrifices had abounded, and the Italian infantry won the admiration of the enemy. In fact, one may read in the Austrian military report on the war: "The front-line official reports are emphatic on the magnificent valor of the Italian infantry and particularly on the conduct of its officers in the field." It should be mentioned that the Italian officers were of the educated classes, while the troops were drawn from the masses of peasants and workers with whom the former had had little contact. The rapport established between these divergent groups by the common struggle and by common sacrifices proved to be one of the greatest revelations of the war.

**Fifth Battle of the Isonzo.**—By the end of 1915, Italian losses had aggregated 66,000 men killed, 190,000 wounded, and 22,500 taken prisoner; Austrian casualties had totaled about 165,000. The Italian Army was close to exhaustion, but the Austrians were fortunately not aware

of its state. Meanwhile, Austrian strength on the front had been increased to 22 divisions. During January and February 1916, demands for operations in Albania and rescue work for the Serbs served to accentuate the poor condition of the Italian forces. When the Germans launched their determined attack against Verdun in February, Marshal Joseph Joffre urged Italian diversionary aid by means of an attack on the Isonzo front. Cadorna responded with a hastily prepared offensive: the Fifth Battle of the Isonzo (March 9–17, 1916). Directed to the north and south of Gorizia, the offensive bogged down in fog, rain, and snow, and served only further to exhaust the Italian troops. Cadorna, learning of an impending Austrian attack from the Trentino, halted the offensive and prepared to meet the new threat.

**Austrian Asiago Offensive (May 15–June 17, 1916).**—Since his days as a young officer, Conrad had considered an attack from the Trentino as the best method of defeating the Italians. Now he believed the time ripe for such an offensive. German aid was requested, but Gen. Erich von Falkenhayn, understanding better than Conrad did the implications of large-scale operations in the Trentino, refused the Austrian request. Nevertheless, Conrad decided to proceed with his *Strafe* (punishment) expedition with the forces available—14 divisions and 4 *Kaiserschützen* regiments, which had replaced the German *Alpen-*



**AUSTRIAN ASIAGO OFFENSIVE (May 15-June 17, 1916).** The Austrians attempted to get behind the Italian main forces on the Isonzo front by an offensive from the Trentino to capture the key rail center of Padua. Difficult terrain, lack of strength, and the timely shifting of Italian forces from the Isonzo front over the excellent rail net in northern Italy all joined to stop the Austrian attack. In June a successful Russian offensive in Galicia (Brusilov offensive) caused the Austrians to dispatch forces from the Trentino and to assume a strictly defensive attitude on the Asiago front.

korps in October 1915. He planned to compensate for his deficiency in troops by assembling huge quantities of medium and heavy artillery.

The objective of the offensive was to drive into the northern Italian plain, capture the key rail center of Padua (Padova), and thus effectively cut off the Italian Carnic and Isonzo forces. The commander of the Italian First Army on the Trentino front, Gen. Roberto Brusati, had been instructed to organize a position in depth to hold off any Austrian offensive moves there. Instead, he engaged in interminable local actions to improve his position, so that when the Austrian blow fell on May 15, 1916, he was caught off balance. Conrad's offensive made good initial gains and captured Arsiero and Asiago, gateways to the northern plain. Here the momentum of the attack declined because of lack of strength, difficult terrain, and the resistance of Italian reinforcements transferred from the Isonzo front. Under the pressure of an Italian counteroffensive and the necessity to shift troops to Galicia, where a Russian attack was impending, Conrad drew his forces back almost to their original positions in the Trentino. The Asiago offensive ended on June 17; Conrad's pet scheme had been tried and found wanting. Losses on each side totaled about 100,000.

**Sixth to Eleventh Battles of the Isonzo.**—After the failure of the Austrian Asiago offensive, Cadorna rapidly began to return his troops by rail and motor to the Isonzo front. The Austrians, who had to move from the Trentino over a longer, less efficient route, were at a disadvantage. As a result, when Cadorna launched the Sixth Battle of the Isonzo (also known as the Battle of Gorizia; Aug. 6-17, 1916), his operations met with immediate success. Both Gorizia and the bastion of Monte San Michele, dominating the northern section of the Carso, were captured. Threatened now from the north, the Austrians on the Carso fell back. Stiffening resistance

and the lack of adequate reserve to force a real breakthrough, however, brought the offensive to a halt. This battle had given the Italians their first real gains of the war; nevertheless, nothing decisive had been achieved.

Subsequent Italian military actions took on political aims to aggravate the "moral crisis" of the Dual Monarchy through a relentless wearing down of its forces that might eventually lead to internal collapse. Since Austria considered the retention of Trieste (Triest) vital, the Italians saw in the capture of that Adriatic city the opening wedge toward the downfall of the Habsburg Empire. The plan was to reach the city, which lay only 30 miles behind the front, by a succession of well-timed, energetic, limited-objective attacks punctuated by well-planned respite to prevent unnecessary losses, thus approaching the major objective by bounds. To this end the Seventh (September 14-17), Eighth (October 10-12), and Ninth (November 1-4) battles of the Isonzo were initiated. The theory was sound, but in practice (and in large part due to the growing insufficiency of artillery) the attacks developed into the same drawn-out and bloody affairs that had formerly characterized fighting on that front. Notable local successes were achieved, but not much progress was made toward the larger goal. The three offensives did disturb the Austrian commander on the Isonzo front, Gen. (later Field Marshal) Baron Svetozar Boroević von Bojna, who requested reinforcements, adding, "The last three battles have shown that the enemy has learned his lessons well and is taking advantage of all past experience in utilizing to the full modern techniques of war." For the Italian soldiers, who knew little of the tremendous strain under which the Austrians were operating, however, these battles seemed disproportionate in terms of results and sacrifices, of victories and losses, and of the means employed and the results attained.

Efforts to refurbish the Italian Army in the autumn of 1916 and the succeeding winter brought imposing results. A total of 16 new divisions were put in the field, and 6 additional divisions were being made ready; medium artillery was doubled, and heavy artillery was increased fourfold; the number of machine guns which at the start of the war had been only 600 was brought to 8,200; a gigantic acceleration in the production of bombs was being spurred; and military aircraft, which had numbered 382 in 1915, were now increased to 3,860, with great improvements in speed, striking capacity, and logistical potential. Early in 1917, Cadorna felt confident enough to resume offensive operations. It had been agreed by the Allies that their efforts in the spring of 1917 would be coordinated. Accordingly, the British attacked at Arras on April 9, the French drove forward on the Aisne on April 16, and the Italians took the offensive in the Tenth Battle of the Isonzo on May 12. This offensive was planned as two coordinated flanking attacks, first against the Bainsizza barrier and later against the Carso. The operations developed into the same exasperating pattern as had the engagements of the preceding autumn. After great losses the battle was halted on May 28. On June 4, a surprise Austrian counterattack deprived the Italians of a number of hard-won positions; the battle ended on June 8.

Cadorna now turned to a limited offensive on the eastern face of the Trentino salient, between



the Valsugana (Suganatal) and Asiago, where he employed 12 divisions and 24 Alpine battalions on a 10-mile front. Under the misnomer of the Battle of the Ortigara, the engagement lasted from June 10 to 29. The battle turned into a Carso-like struggle of attrition waged at an altitude of 6,500 feet. There were initial and occasional brilliant successes, but no major results were attained, and Italian losses were enormous.

This might have been the moment to suspend operations to permit the troops to recoup their strength. The Allies kept pressing for a new offensive, however, and Cadorna was eager to gain a better defensive line, at least on the Isonzo. Concentrating on the river such a mass of men and matériel as had never been seen on that front (51 divisions with 5,200 pieces of artillery), he launched the Eleventh Battle of the Isonzo (August 19–September 12). The Second Army was to gain the Bainsizza Plateau, officially described as "a transitional objective and zone of maneuver opening the way to the capture of the Ternova [Tarnova] Plateau." The Third Army was to attack the Carso and seize the dominating Hermada and the surrounding plateau. Diversionary actions were planned for the north as far as Tolmino.

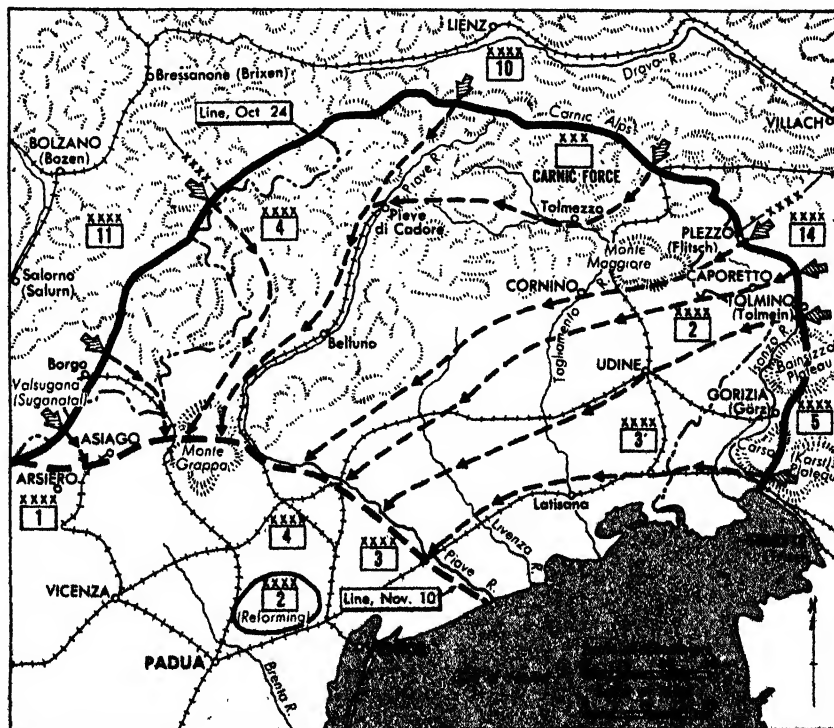
The Third Army attack came to nothing, and on September 4 a powerful Austrian counterattack hurled the Italians once again down the slopes of the Hermada. The Second Army attack failed in its principal purpose through the intransigence of its commander, Gen. Luigi Capello, who converted the diversionary action against Tolmino into the main attack and obstinately continued it even after it had failed. Since the reserve had been allotted for his use, it was lost to the general action. Instead of a single, coordinated offensive with alternating pressures and judicious use of the reserve, three

separate and distinct actions had resulted: at Tolmino, for the Bainsizza, and on the Carso.

The Italian offensives of 1917 had gained notable local tactical successes, including a five-mile penetration into the strongest Austrian defenses. Nevertheless, the pivotal points of the Austrian defense line remained in enemy hands: Tolmino, Monte San Gabriele, and the Hermada. Italian losses had been staggering; once again, and to a greater extent than ever, fatigue, weariness, and frustration gripped the Italian troops, making them prey to an unscrupulous neutralist and defeatist propaganda mercilessly exploited at home and abroad.

**Battle of Caporetto (Oct. 24–Nov. 12, 1917).**—After the Eleventh Battle of the Isonzo, the Austrians on that front were at the point of collapse and might well have succumbed to another offensive. Emperor Charles I now requested the replacement of Austro-Hungarian troops on the Russian and Rumanian fronts by Germans, so that he might throw the entire weight of his armed forces against the Italians. The German High Command felt, however, that the war would be decided on the western front. An offensive against Italy at this time would be justified only if it could definitely knock her out of the war; otherwise, it would merely lead the Austrians to abandon their present excellent defensive positions and perhaps necessitate redeployments to less favorable ones. Nevertheless, the Germans agreed to intervene on the Italian front with a limited number of crack troops fully supported by artillery, air forces, and logistical services. A quick resolute blow was envisioned that would throw the Italians back beyond the Isonzo and, if possible, behind the Tagliamento, in order to afford the Austrians some respite and time to prepare for a victory offensive at a future propitious moment. For this purpose the Austro-German

**BATTLE OF CAPORETTO**  
(Oct. 24–Nov. 12, 1917). German troops were sent to the Isonzo front, and a combined Austro-German offensive was launched. Using new tactics, the Germans quickly shattered the front of the Italian Second Army, whose commander, even though apprised of the coming offensive, had failed to take adequate defensive measures. The Italians were forced into a general withdrawal and succeeded in reorganizing on the line of the Piave River after suffering 320,000 casualties. This disastrous defeat, however, not only failed to demoralize the Italian troops and home front but engendered greater unity and determination to prosecute and win the war.



Fourteenth Army was organized from seven German divisions (including the powerful *Alpenkorps*) and eight Austrian divisions. Gen. Otto von Below, of western front fame, was given its command.

By September 18, Cadorna had become convinced that an Austro-German offensive was impending on the Isonzo. On that date he ordered his Second Army (General Capello) and Third Army (Emmanuel Philibert, duke of Aosta) to assume defensive positions in depth and brace for attack. Having issued the order, he took no measures to supervise its execution, as is incumbent on a commander in chief, nor did he issue any directive for the defensive battle. Meanwhile, the offensive-minded Capello dreamed of a counteroffensive in the Tolmino area and neglected to prepare his defensive position. Cadorna, who spent the time until October 19 inspecting other fronts, was generally out of touch with the activities of his forces on the Isonzo. When he and Capello finally bestirred themselves to reinforce the left flank of the Second Army, it was too late.

Before dawn on Oct. 24, 1917, an intense and effective bombardment fell on the Italian lines. First gas and then high-explosive shells were used. The Italian gas masks offered little protection against the gas, and panic seized the troops. At 8 A.M., the Fourteenth Army moved forward on a line from Tolmino to Plezzo (Flitsch; now Bovec), concealed by a heavy mist that blanketed observation from the heights. Capello had 25 divisions with which to oppose von Below's 15 divisions, but they were under strength, poorly distributed, and in inadequate defensive positions. Using their new tactics of infiltration and relentless pressure, the Germans shattered the front of the Second Army. By evening of October 25, it was clear that a retreat was imperative; Cadorna did not issue the order until October 27, thereby losing two precious days. It was anticipated that at least a temporary stand would be made behind the Tagliamento, but when the enemy crossed the river near Cornino to the north the Tagliamento position became untenable. On November 4, Cadorna ordered a further withdrawal to the Piave. Many troops had been cut off, particularly those of the Carnic Corps, but the Isonzo forces, covered by an excellent cavalry rear guard, reached the strong line of the Piave by November 10. This Caporetto disaster (sometimes called the Twelfth Battle of the Isonzo) cost the Italians 320,000 casualties in killed, wounded, and prisoners and several thousand guns.

Meanwhile, General Cadorna was replaced by Gen. (later Marshal) Armando Diaz. The line of the Piave was organized with the Fourth Army on the left and the Third on the right, while the broken Second Army attempted to reorganize in the rear. A force of 11 Anglo-French divisions, hastily rushed from the western front to Italy, constituted a general reserve, which Cadorna had so sadly neglected. Of the 65 Italian divisions available prior to Caporetto, only 33 divisions were now at full efficiency (4 or 5 others were still partially serviceable). Pitted against them were 50 Austro-German divisions and 4,500 cannon. As the so-called law of Clausewitz (originated by the Prussian Karl von Clausewitz) had foreseen, however, the Austro-German offensive had been reduced in power as it advanced in space. The very speed of the advance had out-

stripped the capacity of the bridge engineers and other essential logistical services.

The Austro-German forces persisted in their efforts to force crossings of the Piave and destroy the Italian Army until December 26, but they were consistently repulsed. Particularly fierce attacks were thrown against stubborn Italian defenders on Monte Grappa but to no avail. Regarding the fight on the Grappa, Gen. Konrad Krafft von Dellmensingen, German chief of staff of the Fourteenth Army, later wrote: "Thus our offensive was brought to a standstill short of its objectives, an offensive which had been so rich in expectations and hopes, and the Grappa became the 'Sacred Mountain' of the Italians. They can be rightly proud that they held it against the heroic efforts of the best troops of both the Austro-Hungarian Army and their German comrades."

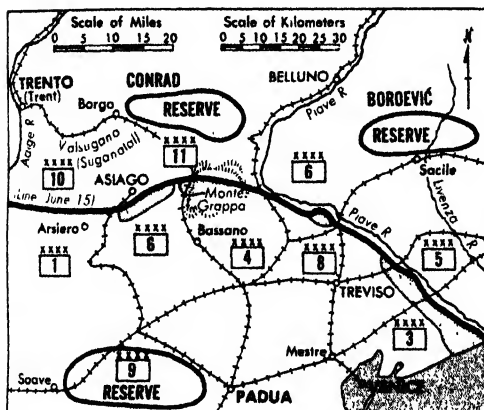
The resurgence of the Italian Army and the home front after Caporetto was truly remarkable. The disaster strengthened the determination of the Italian people; the entire nation at last began to support the war effort. In a few months industry replaced all of the artillery matériel losses, and the supply of munitions was considerably increased. The army proved to be still sound, and during the winter of 1917-1918 it further recovered its strength with marvelous speed. The place of the Second Army was taken by the Fifth Army, which for the moment at least served as the chief reserve of the supreme command. In the meantime, measures were taken to minister to the physical needs and restore the battered morale of the Italian soldier. General Diaz possessed a more humane sense of the soldier's life than Cadorna did, for under the uniform he saw the man and the citizen. New organizational methods for defense and offensive were developed which sought maximum results with a minimum loss of life. Greater emphasis was placed on the use of airpower, intelligence and information services were overhauled, and a central agency was formed to engage in counterpropaganda against the enemy.

There was one other important result of the Caporetto affair. High Allied officials gathered in conference at Rapallo and agreed to form an Allied Supreme War Council to coordinate the activities in all the theaters. This was the first step toward Allied unified command, which eventually materialized under Gen. (later Marshal) Ferdinand Foch.

See also **CAPORETTO, BATTLE OF.**

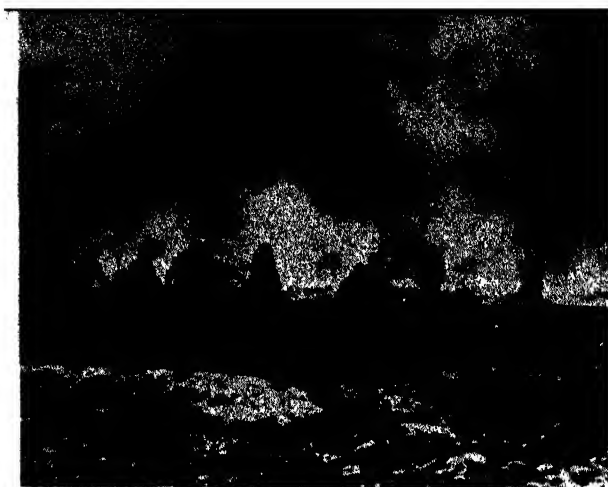
**Battle of the Piave (June 15-24, 1918).**—In the spring of 1918 the Germans began a series of five drives on the western front designed to win the war before American forces could effectively intervene. Locked in a death struggle, each side asked its ally on the Austro-Italian front to attack. The Germans urged an all-out Austrian attack to drive Italy from the war, so that Austrian troops could be transferred to the western front (the 7 German divisions in Italy had already been shifted); Foch wanted an Italian offensive on the Trentino front to circumvent such a move. In March, 6 of the 11 Anglo-French divisions in Italy were sent back to the western front; the remainder moved to the mountains of the Trentino front in preparation for an offensive there. In April, 2 Italian divisions went to France. Diaz saw no advantage in an offensive against the Trentino and vetoed the idea; the Austrians proceeded to attack.

In all, 58 Austro-Hungarian divisions were assembled for the drive; Diaz had 57, including the 5 Anglo-French divisions. Conrad, demoted after his abortive Asiago offensive, commanded in the Trentino; Borojević, on the Piave front. Because of conflicts of personality and inadequate lateral communications, the Austrian forces, including reserves, were divided almost equally between the two sectors, thus denying the possibility of a concentrated effort anywhere on the front. On June 13, a diversionary effort was launched at Tonale Pass to the west of the Trentino; on June 15, the main attack began. By evening minor gains had been made in the Trentino, but these were wiped out by counterattacks and heavy artillery fire on the next day. Borojević had better initial success in the Piave River sector. Crossings were effected at three points; at one an advance of three miles was made. For eight days the Austrians and Italians struggled fiercely in attack and counterattack. Aircraft and artillery struck at the Austrian floating bridges, and the Piave rose sharply to further threaten their destruction. With supplies and ammunition beginning to run out and harassed by Italian counterattacks, Borojević ordered his troops back across the Piave on the night of June 22-23; the movement was completed on June 24.



**BATTLE OF THE PIAVE (June 15-24, 1918).** In June 1918, after the failure of their first three drives on the western front, the Germans were in desperate need of manpower. They therefore urged the Austrians to attack to put Italy out of the war, so that Austrian troops could be sent to the western front. The Austrian offensive against the Italian position on the Piave failed because of the dispersion of effort and the well-planned Italian defense.

Foch, who on July 1, 1918, had become supreme commander of all Allied forces, urged Diaz to exploit this victory and to launch a general offensive in coordination with an Allied offensive against the Soissons salient on the western front, scheduled for mid-July. He judged the Austro-Hungarian Army to be in a state of collapse and ripe for a final push, but Diaz and his principal aide, Gen. (later Marshal) Pietro Badoglio, thought otherwise. Diaz pointed to the Austrian failure in the river operations and was doubtful of Italian success in repeating the venture in reverse, particularly with his armies in their present state, for the Battle of the Piave had been hard fought. He preferred to reorganize, re-equip, and launch a deliberate offensive when he was fully prepared.



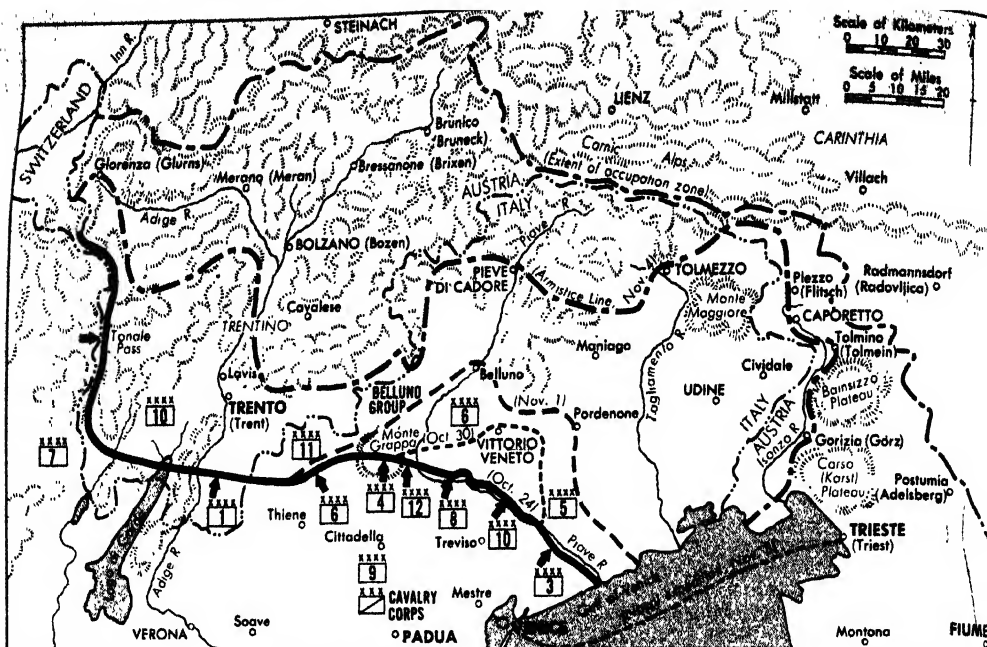
U.S. Navy

Austro-Hungarian troops go over the top as they launch attack in the Battle of the Piave (June 15-24, 1918).

**Battle of Vittorio Veneto (Oct. 24-Nov. 4, 1918).**—For his final offensive, Diaz had 57 divisions (51 Italian, 3 British, 2 French, and 1 Czechoslovakian, plus the United States 332d Infantry Regiment), and his artillery numbered 7,700 guns. Opposing him were 58 divisions and 6,000 guns. The main attack of the offensive was to be made in the center by the Eighth Army of 14 Italian divisions under Gen. (later Marshal) Enrico Caviglia, supported on the right by the Tenth Army of 2 British and 2 Italian divisions under British Lt. Gen. (later Field Marshal) the 10th earl of Cavan, and on the left by the Twelfth Army of 1 French and 3 Italian divisions under French Gen. Jean César Graziani. The plan was subsequently changed so that the Fourth Army (on the left of the Twelfth) would make the initial attack of the offensive on the massif of the Grappa in order to draw the Austrian reserves away from the front of the main attack. The ultimate object of the offensive was to split the Austrian armies and roll them up on the flanks. On the morning of Oct. 24, 1918, Diaz launched his offensive.

Meanwhile, the Allied final offensive on the western front was making good progress, and the Germans were withdrawing under great pressure. Convinced of eventual defeat, the German Reichstag had signified on October 20 its acceptance of President Woodrow Wilson's Fourteen Points as part of a basis for an armistice. Earlier, on October 4, the Austrians had appealed to the president and had begun to assemble an armistice commission.

If the political leaders of the Central Powers were in a mood for an armistice and peace, this attitude was not as yet reflected at the fighting front on the Piave. For three days the Austrians resisted the attacks of the Italian Fourth Army on the Grappa in a fierce, determined manner reminiscent of the early battles of the Isonzo. Territorial gains were minimal on both sides, but the Fourth Army succeeded in its objective of attracting the Austrian reserves from the front of the main attack. In the meantime, the Eighth, Tenth, and Twelfth armies began crossing the Piave on their fronts. By October 27, Italian, French, and British contingents had established three small bridgeheads, but until noon of October 28 the situation appeared to be grave all along



**BATTLE OF VITTORIO VENETO (Oct. 24–Nov. 4, 1918).** The Italians made great preparations for a final offensive to defeat the Austrians. In October 1918, as Marshal Ferdinand Foch's general offensive on the western front pushed back the Germans, the Italians launched their all-out offensive. The main attack, made by their Eighth and Tenth armies, penetrated the enemy position, and the Austrians broke. The Cavalry Corps, held in readiness for the purpose, rushed through the breach to exploit the success. By November 4, when an armistice became effective, approximately 500,000 Austrians had been taken prisoner.

the line. On the afternoon of that day, however, the situation changed: part of the Eighth Army broke through over bridges opened by the Tenth Army and advanced toward Monticano. At that moment the Austrian Sixth Army, on the Italian Eighth Army front, received orders to retire to its second line of defense. October 29 proved to be the day of decision, as Austrian resistance began

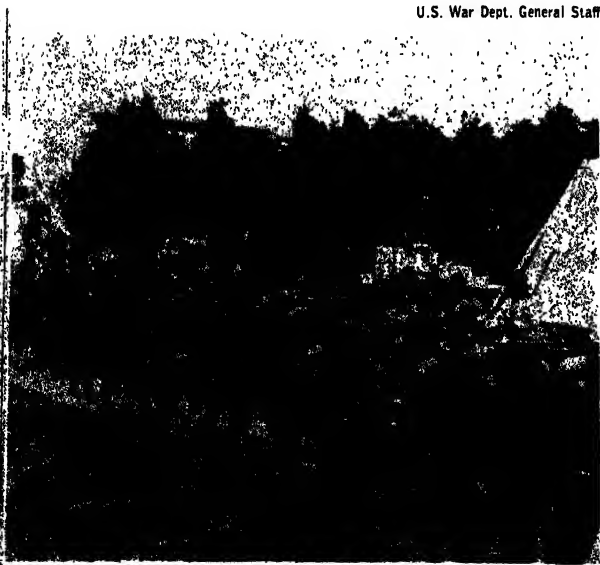
to falter before the determined advance of the three central armies. In some places the Austro-Hungarians stood their ground fiercely, in other they made a half-hearted stand, and in still other sectors they crumbled. The real dissolution occurred among the Austrian reserves; some refused to counterattack, while others mutinied.

The final collapse began on the night of October 30–31, when the struggle turned into a series of isolated encounters, of Austrian units cut off, pursued, captured, and overtaken by advance troops. In these operations after the breakthrough the Italian Cavalry Corps played a splendid role. On the afternoon of November 3, Trento was occupied, and a few hours later a naval expedition landed Italian *Bersaglieri* at Trieste. In the early evening the armistice was signed at Villa Giusti, near Padua. Approximately 500,000 Austro-Hungarian prisoners were taken in this final Italian offensive.

**General Commentary.**—The political and psychological crisis which had gripped the Austro-Hungarian Army in the final phase of the war should not obscure the fact that the Italian victory was the result of more than three years of arduous struggle which had cost the lives of 650,000 Italian troops and the maiming of almost 1,000,000 others. Moreover, the Italian contribution was not limited to the Austro-Hungarian front. The Italian 2d Army Corps was sent to the western front, where it participated with distinction in the Second Battle of the Marne. Approximately 100,000 Italian workers were employed in French war industries; at the same time, they constituted the manpower pool from which the ranks of the 2d Corps were replenished. An Italian division of 35,000 men fought with the Allied Salonika armies in Macedonia, and five

The first American troops to serve in Italy arrive in camp near the Austrian front in September 1918.

U.S. War Dept. General Staff



Italian divisions were engaged in Albania. Italy mobilized a greater percentage of her male citizens than did any other Allied nation except France.

The activities of the Italian Army had been fully supported by those of the Italian Navy. Though the Italian Fleet was superior to that of the Austrians in many respects, it operated under the handicap of a lack of adequate bases on the Italian side of the Adriatic Sea, while the Austrians possessed numerous excellent and strongly defended ports on their side. Nevertheless, the Austro-Hungarian Navy, except for occasional minor sorties and raids, was kept virtually bottled up within its well-protected harbors. An especially arduous and valiant feat performed by the Italian Navy was the rescue of the bulk of the Serbian Army, which had been driven from its homeland by an overwhelming German-Austrian-Bulgarian offensive to the coast of Albania, on the Adriatic. Faced by continual threats from nearby major Austrian naval bases, the Italian Fleet transported in safety to Corfu 260,895 men, 10,153 horses and other animal stock, 68 cannon, and much equipment during the period Nov. 22, 1915–March 4, 1916.

See also separate biographies of the leading generals; section 15. *Diplomatic History of the War*; ITALY—3. *History* (Modern Italy): The Post-Risorgimento Period.

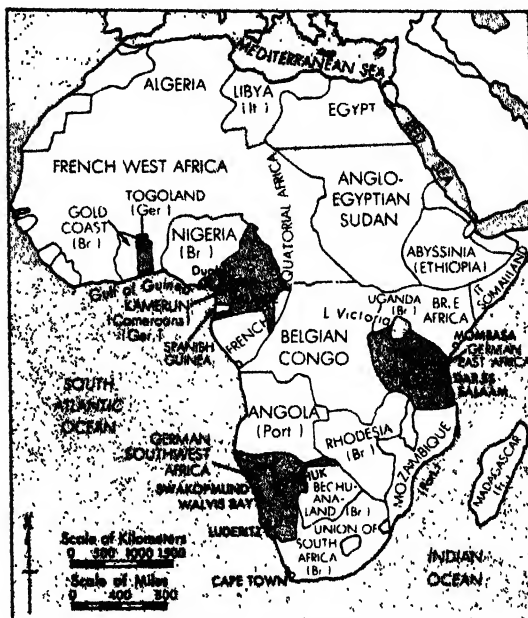
PIERO PIERI,  
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## 10. Colonial and Japanese Campaigns

In 1914, Germany possessed a vast colonial empire with territories in Africa, Asia, and the Pacific. Its area exceeded 1,000,000 square miles, and its population was about 15,000,000. Less than 25,000 of the inhabitants of the various colonies were German nationals, and these were mostly administrators and settlers. In Africa the colonies were Togoland, Kamerun (Cameroons), German Southwest Africa, and German East Africa (Tanganyika); in Asia, Kiaochow, a protectorate in China's Shantung Province; and in the Pacific, the Bismarck Archipelago, Western Samoa, Kaiser-Wilhelmsland (northeastern New Guinea), the Caroline, Marshall, and Mariana Islands (except Guam, a United States possession), and part of the Solomon Islands. Although the eventual fate of these colonies would depend on the outcome of the war in Europe, the Allies could not allow them to remain unmolested, for they provided excellent bases for German warships and commerce raiders and had long-range wireless communications systems. The Germans had a grand plan for the mastery of Central Africa from coast to coast, including the Belgian and Portuguese possessions. This aim was to be furthered as the fortunes of war in Europe permitted.

The nature of the military campaigns in Africa differed sharply from those in other areas. Roads and trails were few and poor; whenever possible, operations were conducted either along the rivers, receiving their support by boat, or along the few railroad lines. Logistical support of overland operations was provided primarily by native carriers, who generally far outnumbered the combat troops they supported. (The tsetse fly abounded in many areas and quickly killed any transport animals or cattle brought in.) The military forces on both sides consisted chiefly of trained natives formed into companies officered

by Europeans, with, on occasion, a leavening of white units. Native police forces of the German colonies had received some military training and were employed at times. Advances were of necessity difficult and slow, the relatively small forces operating in the vast tropical areas could evade each other easily, and disease killed and incapacitated far more combatants and carriers than battle did.



German possessions in Africa in 1914.

**Togoland.**—Togoland (now divided between Ghana and the Republic of Togo) had a maximum width of 90 miles and extended inland for 330 miles from the Gulf of Guinea. About 100 miles from the coast the Germans had installed a powerful wireless station that gathered information from the other German African colonies and relayed it to Berlin. On Aug. 7, 1914, British and French forces attacked Togoland from the west and east, respectively. The small garrison of 200 Germans and about 1,000 native troops withdrew before the advancing Allied forces toward the wireless station at Kamina, where, on August 26, it was penned in and surrendered after destroying the wireless facilities. A Franco-British administration was set up, and in a few weeks normal peace conditions again prevailed.

**Cameroons.**—The Cameroons (now divided between the Republic of Cameroun and Nigeria) occupied 200,881 square miles in the Gulf of Guinea. Inland the country consists mostly of forest, bush, and grassland, with a hilly area in the north. The coastal strip, with its mangrove swamps and heavy rainfall, was among the most pestilent areas in Africa. On August 20, two French columns (including a Belgian contingent) entered the Cameroons from the southeast, beginning a trek that was to extend for more than 300 miles through desolate and forbidding territory; and between August 25 and August 27, three British columns crossed the Nigerian-Cameroons border. After modest initial gains, German counterattacks in early September forced the British



back across the border in great disorder. The complete failure of the attack is attributed to inadequate preparations, topographical ignorance, and the rainy season then in progress.

A Franco-British naval-military expedition up the Wouri River was now organized. Better prepared, it met with greater success than the land attack. On September 27, Duala (now Douala), 20 miles up the river, was captured, although most of its garrison escaped. The Allies pursued the Germans to Edéa, 35 miles to the southeast, which they occupied on October 26. After an unsuccessful counterattack on Edéa, the main German forces withdrew toward Yaunde (now Yaoundé), 100 miles to the east, where their munitions facilities were located. It was their plan to hold out on this high ground until the soon-expected German victory in Europe.

The Allied plan was to converge on Yaunde from all directions, but it was to be more than a year before they reached the town. The advance was conducted under the most demoralizing conditions. Swamps, forests, and tropical heat impeded progress; columns had to travel great distances without transportation and communications; small German detachments harassed the troops in guerrilla operations, and hostile natives set up ambushes, making it necessary to build and garrison blockhouses every 20 miles; the rainy season intervened to halt the advance completely for a long period; and tropical diseases, principally dysentery, thinned the Allied ranks. On Jan. 1, 1916, the British entered Yaunde from the north, only to find the town evacuated; the German forces had begun a 125-mile march to neutral Spanish Guinea in the south. Efforts to cut them off failed, and they were interned safely by the Spaniards. Oddly enough, marching and fighting far apart and without communications for almost a year and a half, the Allied columns converged on their objective, Yaunde, within a few days of each other. By mid-February 1916, the last of the small isolated garrisons had been captured. White prisoners were sent to England, and natives to their homes. A joint Franco-British administration was established.

The maximum German strength in the Cameroons reached 8,000 white and native troops; in the final advance the Allies employed 24,000 troops (10,000 French, 8,000 British, and 6,000 Belgian), in addition to 40,000 native carriers. Battle losses were small on both sides; disease exacted the major toll, particularly among the native carriers.

**German Southwest Africa.**—German Southwest Africa (now South West Africa) covers 317,725 square miles on the Atlantic coast of the continent. Primarily desert and bush, it has few rivers and meager rainfall. In 1914 it had a population of about 15,000 whites and 100,000 natives, chiefly Hottentots, Bushmen, and Bantu. Most European powers had shown little interest in the area, although the British occupied the fine port of Walvis Bay and annexed it to Cape Colony in 1878, and Germany took over the territory in 1884 primarily because it would look imposing on the map. Later the territory was found to be rich in minerals, particularly diamonds. Railroads ran several hundred miles inland from the German ports of Swakopmund and Lüderitz. The capital, Windhuk (now Windhoek), lay 170 miles inland on high ground. There a powerful wireless station had been installed.

**Allied operations against the German colony** were assigned to the troops of the Union of South Africa. Originally, it was intended only to capture the German ports to prevent the supply of naval surface raiders. On September 13, Lüderitz was captured, but further operations were brought to a halt by the defection of two of the South African military leaders, Brig. Gen. Christian F. Beyers and Lt. Col. Solomon G. Maritz. Beyers fanned the smoldering disaffection among segments of the Afrikaners, and Maritz joined the Germans, threatening an invasion of South Africa. Approximately 30,000 troops were needed to quell the widespread uprisings. Then, in January 1915, operations in German Southwest Africa were resumed with vigor under Gen. Louis Botha. A force of 20,000 men, which Botha commanded personally, landed at Swakopmund and proceeded toward Windhuk; one of 25,000 advanced inland from Lüderitz; another of 8,000 moved in from the south; and a fourth of 2,000 crossed the eastern border. More than half of the troops were mounted. Logistical support presented great problems, for all supplies and much of the water had to be brought from Cape Town and conveyed inland by oxcarts, mule wagons, and automobiles. Large groups of natives were employed day and night to shovel shifting sand from the railroads. All of the native tribes united with an eager desire to help the South African troops against their former masters. They were not permitted to fight, but were employed as scouts and transport drivers.

The advance was slow but inexorable. Once driven from the railroads, the hopelessly outnumbered Germans were forced to flee, for they could not establish defensive positions in the desert wastes. On July 1, 1915, they made a final stand at Otavi, at the end of the railroad. Cut off from further retreat to the north by Botha's cavalry, 3,500 Germans surrendered unconditionally on July 9 (1,500 others had been captured previously). The Union of South Africa was assigned the administration of the territory.

**German East Africa.**—German East Africa (now Tanganyika), the greatest and richest of the German colonies, covers 361,800 square miles. Its western border is mountainous; lakes abound in the west, and rivers in the east. In 1914 the colony was sparsely settled by a population of about 8,000,000, including 5,500 whites. The road net was fair by tropical standards, but few roads were fit for motor transportation. One railroad traversed the middle of the territory, and another joined the port of Tanga with the key base of Moshi.

The German garrison, initially small, never exceeded 3,500 white and 12,000 native troops even when augmented. It was commanded by Lt. Col. (later Maj. Gen.) Paul von Lettow-Vorbeck, a determined and crafty leader. At the beginning of the war the British forces in the adjacent colonies were almost negligible. Since the forces of the Union of South Africa were occupied in conquering German Southwest Africa and in suppressing rebellion, a call was made for India to send troops. Meanwhile, the British enlisted whatever natives they could and assembled them to defend the vital Uganda Railway, which paralleled the border and in places was 50 miles from it.

Hostilities began on Aug. 8, 1914, when British landing parties destroyed the wireless station and floating dock at Dar es Salaam. Lettow

busied himself with border raids in Rhodesia while preparing for an invasion of British East Africa to the north. Indian troops arrived just in time to repel a German attempt against the Uganda Railway in September. In October, an advance against the key British coastal port of Mombasa was similarly halted. Additional Indian troops arrived in November and attempted to capture Tanga. A landing was made on November 2, but, constantly attacked and harassed by the Germans (and swarms of wild bees), the troops were forced to return to their ships on November 4 after suffering severe losses. Sporadic and indecisive fighting took place along the lakes and frontiers until the end of 1915. By then the British had been ejected from German territory, and Lettow held stretches of British East Africa, including a portion of the Uganda Railway north of Moshi.

The fall of German Southwest Africa in July 1915 had permitted the transfer of South African troops to the east, and in March 1916 the British, under Lt. Gen. Jan Christiaan Smuts, launched an offensive. The Germans were driven from the Uganda Railway on March 9, and four days later their base at Moshi was captured. Then followed a long series of operations designed to outflank and capture Lettow, in which Belgian troops from the Belgian Congo and Portuguese from Mozambique joined. Lettow proved elusive, however, and by the end of 1916 had fallen back south of the Rufiji River. It had become clear to Smuts that the Indian and white South African troops, highly vulnerable to disease and roadbound in their tactics, were unsuited to the prevailing guerrilla type of operations. They were replaced by Nigerian troops, who could better match Lettow's forces in bush fighting. In January 1917, Smuts left for an imperial conference in London and was succeeded by Maj. Gen. Sir Jacob Louis van Deventer, a South African. In July, when the rainy season ended, van Deventer took the offensive vigorously. Lettow's principal force of 5,000 troops was surprised and captured just south of the Rufiji on November 28. Meanwhile, Lettow and his remaining small force crossed into Mozambique. Portuguese and British troops pursued him down and up the length of Mozambique, then back into German East Africa, and finally into Northern Rhodesia—a distance of 1,600 miles. It was not until Nov. 25, 1918, almost two weeks after the armistice in East Africa, that Lettow surrendered his force of 1,300 men. It had been his plan to wend his way across Africa to Portuguese Angola.

Lettow's campaign in East Africa is a classic of guerrilla warfare. With only a handful of men, he kept 300,000 enemy troops busily engaged during most of the war at a cost to Britain alone of about \$350 million. He inflicted about 15,000 battle casualties, but casualties among Allied troops and transport followers caused by disease acquired in the pursuit totaled almost 700,000.

**Kiaochow.**—The German colony of Kiaochow occupied about 200 square miles on a sheltered bay in the Chinese Province of Shantung. The city of Tsingtao, at the head of the peninsula, was a naval station garrisoned by about 4,000 German marines, which had been developed into a strong fortress at a cost of \$100 million. Heavy guns covered the coast, and three strong and deep defensive zones, extending across the neck of the peninsula, guarded the base proper. Tsingtao's

excellent harbor made an ideal base for the German Far East Squadron, which sailed for the high seas at the outbreak of war in 1914. On August 15, Japan delivered an ultimatum to Germany, demanding the evacuation of Kiaochow. The Japanese declared war on August 23, and opened the campaign by occupying the islands outside the harbor four days later. On September 2, Japanese troops landed at Lungkow, 110 miles north of the fortress, with the object of isolating and attacking it from the landward side. Heavy rains thwarted this project, and the Japanese turned to aerial bombardment of ships in the harbor and military installations. On September 18, another landing was made, this time closer to the outer defense line. British forces from Hong Kong landed on the seaward side on September 23, and joined with the Japanese to form a cordon across the peninsula. Lacking sufficient troops to hold them, the Germans withdrew from the two forward positions; the British-Japanese forces followed to within 5 miles of Tsingtao. Noncombatants were permitted to leave the town on October 15, and were conducted through the Allied lines.



The Bettmann Archive

German marine artillery at Kiaochow, China, in 1914. Colony was surrendered to the Japanese on November 7.

The Japanese now began a relentless and deliberate advance, using the methods of regular siege warfare. On October 31, they opened a bombardment of the German defenses with heavy howitzers, while British and Japanese warships pounded key German defensive installations. By November 6, Japanese siege parallels had reached within 300 yards of the main German defenses. That night a general assault captured the last infantry redoubts, and early the next morning the Germans surrendered. They had suffered 700 casualties; the remainder of the 4,000 garrison troops were taken to Japan as prisoners. The Japanese had employed 23,000 troops, and the British 1,500; their casualties had been 1,800 and 70, respectively. Administration of the German colony was assigned to the Japanese, effective until the end of the war, when they were to open negotiations with China.

**German Pacific Islands.**—There were very few German nationals in the Pacific island colonies, and these were primarily civilians. Unable to be reinforced from the homeland, the islands were easy prey for Allied forces. The principal German possession in the Pacific was Kaiser-Wilhelmsland, situated in northeastern New Guinea. It covered 69,700 square miles and had a population of about 500,000, of whom 300 were Germans. The large number of German-held islands in the Bismarck Archipelago to the northeast, including Neu Pommern (New Britain), Neu Mecklenburg (New Ireland), Neu Lauenburg (Duke of York Islands), the Admiralty Islands, and Neu Hannover (Lavongai), were populated by 200,000 natives and 300 Chinese and Germans. The Solomon Islands to the east were partly German and partly British. The Western Samoa group (the other German South Sea possession) contained about 500 Europeans (chiefly British and German), 1,500 Chinese, and 15,000 natives. Farther out in the Pacific lay the Carolines, the Marshalls, and the German islands of the Marianas chain.

While Australian, British, and Japanese warships patrolled the Pacific hunting for German cruisers in 1914, Allied forces undertook the capture of the German islands. A New Zealand force of 1,500 landed at Apia on Upolu Island on August 29 and took possession of Western Samoa without opposition. On September 11, an Australian expeditionary force of 1,500 landed unopposed on Neu Pommern. It took possession of Kaiser-Wilhelmsland on September 17, and subsequently occupied the adjacent island groups. Meanwhile, the Japanese captured the outlying islands.

By the terms of the Treaty of Versailles, Germany was deprived of all her colonies. France and Great Britain were instructed to make a joint recommendation as to the future of Togoland and the Cameroons. Mandates for the rest of the colonies were apportioned as follows: German East Africa, Great Britain; German Southwest Africa, the Union of South Africa; Western Samoa, New Zealand; other former German Pacific possessions north of the equator (the Marshall, Caroline, and Marianas groups), Japan; other former German Pacific possessions south of the equator, Australia (Nauru, assigned to the British Empire, also was actually under Australian control).

See also section 15. *Diplomatic History of the war*; separate articles on the former German possessions; MANDATES SYSTEM.

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## 11. Turkish Campaigns

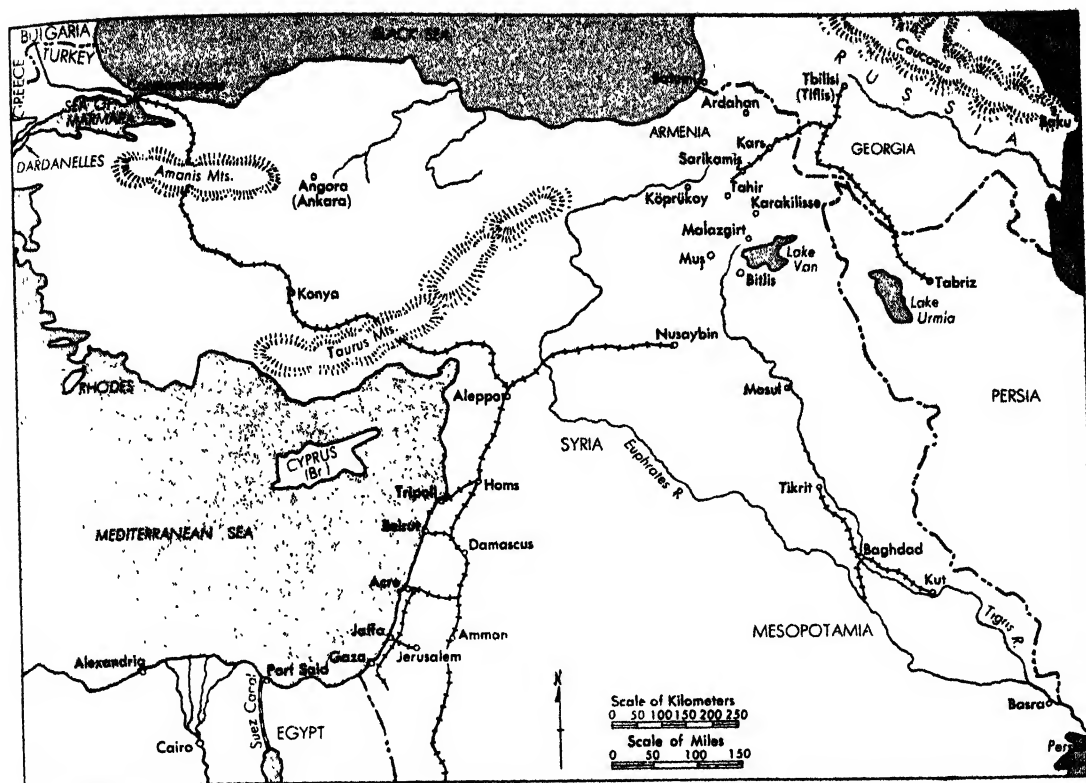
At the outbreak of World War I, Turkey was politically and militarily in a state of transition. The Young Turk regime was thoroughly established, but it was not united, nor had it recovered from the crushing defeat suffered in the Balkan Wars of 1912-1913. The army was being restored and rearmed by a German military mission. At the same time, Britain was endeavoring to carry out a similar task for the navy, with poor prospects by comparison, since whereas the army contained magnificent fighting material, the navy was largely antiquated. The division of sentiment in the Turkish government was represented by Ahmed Djemal Pasha, the navy minister, and Enver Pasha, the war minister. The

former was an old-fashioned Pan-Turk who was prepared to keep out of war if possible, though he was by no means as wholehearted in this resolve as the grand vizier, Mehmet Said Halim Pasha. Enver, on the other hand, had adopted and in part invented the creed of Pan-Turanism, which sought to embrace all speakers of Turanian (Ural-Altaic) languages, and he was indifferent to the fate of the Turkish possessions in the purely Arab countries. He was determined on war.

On Aug. 2, 1914, a secret treaty providing for the subsequent entry of Turkey into the war on the side of the Central Powers was signed with Germany. At the last moment, the government had misgivings because the forces of the Allies were making a better showing than had been expected, but Enver pressed for Turkish belligerency. In this he had the collaboration of German Vice Admiral Wilhelm A. T. Souchon, whose determination had enabled him to escape the powerful fleets of France and Britain in the Mediterranean Sea and to bring the battle cruiser *Goeben* and the light cruiser *Breslau* safely through the Dardanelles. The arrival of a modern battle cruiser at Constantinople (now Istanbul) transformed Turkey's naval position and threatened the Russian Black Sea Fleet, which included no warships of the dreadnought type nor any with the *Goeben's* speed. The two ships were nominally embodied in the Turkish Navy; and on October 29, Souchon led the combined fleet in the bombardment of the Black Sea ports of Novorossisk, Feodosiya, Sevastopol, and Odessa, thus ensuring war with Russia. Russia declared war on Turkey on November 1, and Britain and France followed suit on November 5.

Meanwhile, Turkey had mobilized 36 divisions by the end of September. The head of the German military mission, Gen. Otto Liman von Sanders, was a man of ability, energy, and integrity, and all the work which he was able to supervise was admirably done. The situation in Turkey's Arab possessions was another matter. The Baghdad Railway (q.v.) included great gaps, which were covered by execrable roads over which all supplies had to be borne because the tunnels through the Taurus and Amanos Mountains had not been pierced. Moreover, on the east side of the mountains the railway extended only halfway between Aleppo (Halab) and Mosul, the terminus being Ras el 'Ain. For these reasons, it was impossible to make nearly as good progress east of the Taurus as west of it. The garrison at Yemen, in southwestern Arabia at the southern extremity of the Ottoman Empire, seemed useless, although it actually proved a sharp thorn in the British flank by maintaining a siege of Aden throughout the war. The reinforcement of the Turkish garrison in Syria was paralleled and indeed proportionately exceeded by that of the British garrison in Egypt. The Regular infantry brigade and the regiment of cavalry stationed there at the beginning of the war were sent to fight in France, but they were replaced by two Indian and two British Territorial divisions under the command of Gen. Sir John Grenfell Maxwell, who had a long experience of the country.

**Operations in the Caucasus, 1914.**—Throughout the war the Caucasian theater was to a great extent divorced from the conflict at large and even from the main Russian front. The Turks were able to put their finest troops into the area, whereas the Russian High Command consistently drained it to fill gaps in other Russian theaters of



Turkish Empire in 1914.

operations. The area with which the Caucasian theater became most closely connected was the British theater of Mesopotamia, where a slender Russian spearhead joined it through Persia (Iran). While the Russians in Asia Minor created troops as good as all but the best that they lost, drawing them from such local peoples as the Armenians, in the beginning the odds favored the Turks, who could put into the field 150,000 men to the Russian 100,000, and those distinctly the better trained. The opposing armies were commanded by Hassan Izzet Pasha and General Myshlayevski.

On the Turkish side, however, Enver himself was the strategist, and Hassan Izzet the tactician who had to implement the minister's plans and remedy his errors, a task which proved beyond this hard-fighting and devoted man. Enver was a professional soldier, but he did not know how to conduct a campaign, although he saw himself as a Hannibal or a Napoleon. He could deduce from the map that everything depended on the roads, but he could not assess the handicaps. His aim was to draw the main body of the Russians forward and then by a lightning stroke put an overwhelmingly strong Turkish force between them and their main bases, Ardahan and Kars. By this means, he was confident that he could destroy the bulk of their Caucasian army and complete his victory by the invasion of Georgia, where the Turanian peoples would rise against Russia. Enver's plan might have succeeded in summer, but in midwinter the troops had to live on the country because their trains could not reach them through the heavy snow. Night temperatures regularly fell to

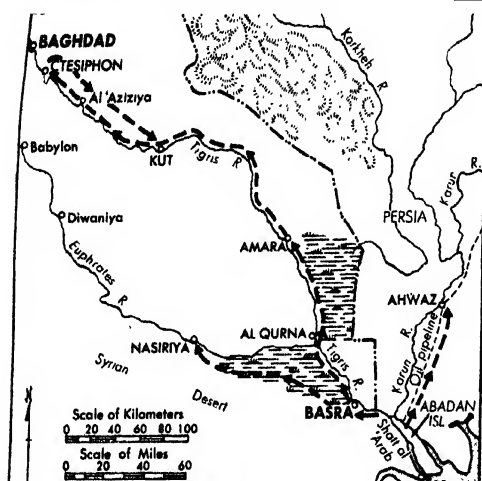
—20° F., and winds rose to gale force on the higher ground.

While Turkish forces in the Caucasian theater totaled 150,000 men, Hassan Izzet's army numbered only 95,000, although it was still in a proportion of three to two against Myshlayevski's. Both sides fought bravely, and death came swiftly and mercifully to the wounded. One Turkish division started its march 8,000 strong, and after four days in the mountains was reduced to 4,000 men. In the deployment phase of the campaign alone, Hassan Izzet lost 25,000 men from a combination of frost and desertion. The great Russian victory was won at Sarikamis, 33 miles southwest of Kars, between Dec. 29, 1914, and Jan. 2, 1915. By mid-January, the force of 95,000 Turks had fallen to 18,000. One brilliant soldier was revealed in the campaign. He was Nikolai Yudenich, who served as senior staff officer to Myshlayevski and was later in command of an army corps.

**Beginning of the Campaign in Mesopotamia, October–November 1914.**—British operations in Mesopotamia (now Iraq) during the war developed from a minor protective measure into a big and costly operation. At the end of September 1914, the India Office suggested that a reinforced brigade be sent to the head of the Persian Gulf. The main object of the expedition was to protect the installations of the Anglo-Persian Oil Company (later, Anglo-Iranian Oil Company) on Abadan Island, at the end of its pipeline. It was also expected to confirm the sheikhs of Kuwait and Mohammereh (now Khurramshahr) in their allegiance to Britain.

After the expedition reached Bahrain on Oc-

tober 23, the British government gave its approval to an advance to Basra (al-Basrah), which was suitable as a base. The city was taken on November 22 after relatively hard fighting in which British and Indian casualties were by far the heaviest of the year in Mesopotamia, totaling 489. Once the force had made a ceremonial entry into Basra and the Union Jack had been hoisted, a proclamation of extreme subtlety was read in Arabic by the chief political officer, Sir Percy Cox, later to become a figure of world celebrity.



**OPERATIONS IN MESOPOTAMIA, 1914-1915.** In December 1914, the British advanced northward from Basra. They seized Ahwaz in May 1915, thereby driving the Turks from the important oilfields and pipeline. In July, the Turks were ejected from Nasiriya. Maj. Gen. Charles V. F. Townshend, commanding the main British column, advanced along the Tigris River and seized 'Amara in June, Kut in September, and Al 'Aziziya in October. In November, he ran into the Turks entrenched at Ctesiphon and was badly defeated. He then retired to Kut; the Turks followed and besieged the city.

It must be recalled that Britain had treated Turkey in a spirit of friendship up to the moment when she was maneuvered into the war against the will of her wisest ministers, hoping to the last that she would succeed in maintaining her neutrality. This spirit was maintained in the proclamation, though it was addressed to Arals and Kurds:

Let it be known to all that from of old the British Government has had many millions of Mahomedan subjects, more than any other power in the world, more even than Turkey.

As is well known, Great Britain has in the past always displayed friendship and regard for Turkey; and a few months ago, when war broke out between certain of the powers of Europe, the British Government urged most strongly on the Sublime Porte that the Ottoman Government should on no account join in the conflict, as such a course was opposed to the best interests of Turkey. Furthermore, in this connection Turkey was assured that so long as she refrained from participation in the war the British Government and her allies would guarantee the maintenance of her independence and integrity. Unfortunately the Turkish Government did not accept or attend to the advice of the British Government in this regard, for the reason that she was misled and tricked by German intrigues to such an extent that she committed numerous acts of hostility which forced the British Government into a state of war with her.

The British Government has now occupied Basra, but though a state of war with the Ottoman Government still exists yet we have no enmity or ill-will against the population, to whom we hope to prove good friends and protectors. No remnant of Turkish administration now remains in this region. In place thereof the British flag has been established, under which you will enjoy

the benefits of liberty and justice, both in regard to your religions and your secular affairs. . . .

The statements in the proclamation were very much to the point, but from another aspect the expedition was typical of the private wars initiated by the India Office and the Colonial Office, which barely consulted the War Office until they needed its help in extricating themselves from untenable situations. To some extent, this state of affairs endured throughout the war.

**Operations in the Caucasus, 1915.**—The peril of the invasion of Russian territory from Asia Minor, which had been averted at Sarikamis at the beginning of 1915, became even more pressing in the course of the year, especially after the Austro-German victory on the eastern front, which started with the Gorlice-Tarnów breakthrough. Turkey itself was not seriously engaged in other areas until the grip of the Gallipoli campaign began to be felt. The German staff at Constantinople reconstituted the shattered Turkish divisions and created new ones, and in the course of the year Turkish strength rose from 500,000 men in 40 divisions to a peak of 800,000 men in 52 divisions.

Meanwhile, the staff of the corps commanded by General Yudenich, relying on reports that were unconfirmed by strong fighting reconnaissance, estimated the strength of the Turks in the hills north of Lake Van as three or four divisions, whereas there were actually eight. Yudenich directed his subordinate, General Oganovski, to drive the enemy from the hills by a rapid advance. Not even the very strong resistance encountered warned Oganovski immediately of his danger, and when the warning came it was too late. The Turkish commander, Abdul Kerim Pasha, advanced with odds of three to one in his favor and caught the Russians just as they thought they had reached a refuge at Malazgirt, which covered the only north-south road for some miles. In his distraction, Oganovski submitted no adequate report, and Yudenich did not learn the full truth until he sent a staff officer to Malazgirt. Within a week the remnant of Oganovski's force was in flight, having lost all its artillery and transport. Enver ordered Abdul Kerim to drive the Russians across the frontier, but the latter suspected that his communications might be attacked and advanced with caution.

Though his resources were slender, Yudenich assured the viceroy in Tbilisi (Tiflis) that there was no cause for concern. The force that he was able to scrape together numbered little over 20,000, of whom a fair proportion were cavalrymen, and he assembled it between Köprükoy and Tahir, where the road to Karakilisse (now Karaköse), which the Turks had reached, branched off the main road to Kars. He placed this force under the command of Gen. N. N. Baratov and ordered him to drive across the enemy's lines of communication and sever them. The Turks hastily retreated, while Baratov's Cossacks captured a great number of guns and much food in the blocked streets of Karakilisse. The Turks were reported to have lost 10,000 killed and wounded, and they left 6,000 prisoners in Baratov's hands. It was a notable victory, but Yudenich lacked the means to exploit it.

**Campaign in Southern Mesopotamia, 1914-1915.**—The British force in Mesopotamia moved north from Basra and captured Al Qurna (al-Qurnah) on Dec. 9, 1914. It now received orders to take 'Amara ('Amarah), nearly 70 miles far-



ther up the Tigris. Moreover, whereas all the earlier operations had been conducted astride the Shatt-al-Arab or the Tigris, the force was now directed to secure Nasiriya (al-Nasiriyah) on the Euphrates River and Ahwaz on the Karun River and the pipeline. Although there were good arguments in favor of these fresh advances, they represented another instance of the policy of taking steps without any clear conception of where they were to lead, but giving the impression that they were designed to force the hand of the British government and induce it to attempt the capture of Baghdad. At this time, only 21 river steamers and tugs were available for operations.

Meanwhile, another brigade and supporting artillery had arrived in Mesopotamia, and it had been decided that a senior officer of the Indian Army, Gen. Sir John Nixon, should set up a corps headquarters to command the two infantry divisions and the cavalry brigade now in the country. The Turks were very weak on the Tigris, in contrast to their left wing of 8,000 men near Ahwaz and their right wing of 18,000 men on the Euphrates, which together constituted two divisions and a cavalry brigade, or exactly the strength of the total British force. The Turks' center consisted merely of a detachment of gendarmerie, and their east-west communications, though much better in the drought of spring and summer than in the floods of winter, took some time to pass between the two wings.

Maj. Gen. (later Sir) Charles V. F. Townshend advanced up the Tigris and, after a series of minor operations, on June 3 seized Amara at small cost. The task of Maj. Gen. (later Sir) George F. Gorringe proved more arduous. He suffered at least one sharp check and had some trouble in seizing Ahwaz, but the difficulties of his two months' advance were due almost entirely to lack of sufficient transport and grilling heat. Strategically, this was the most valuable operation since the original landing, because the enemy was driven from the oilfields, which were not threatened again during the war. Gorringe went straight to the next undertaking and took only half as long to capture Nasiriya, which he occupied on July 25.

**Advance on Kut, 1915.**—It would have been well if Gorringe, who was a steady, painstaking soldier, had been entrusted with the next venture, an advance up the Tigris to Kut (Kut al-Amarah). Townshend, the commander to whom it was allotted, was of a very different type. Already celebrated for his achievements in the North-West Frontier Province of India, he was very much a showman. He would be certain to support any form of forward policy and perhaps to move in advance of orders, as he can be said to have done when he pushed on from Kut, which he took on Sept. 28, 1915, to Al 'Aziziya (al-'Aziziyah). His force at this period was short of physicians and medical equipment, and as soon as it became engaged in the first heavy fighting of the campaign, the medical system broke down, and a great number of unnecessary deaths occurred.

Townshend reached Al 'Aziziya without difficulty on October 5, but then he was delayed by a fall in the depth of the Tigris. To supplement the river boats, a motley assortment of camels, horses, mules, and asses were assembled. Townshend had been forbidden by Nixon to advance any farther, but the British cabinet, anxious to regain popular support, which it was losing be-

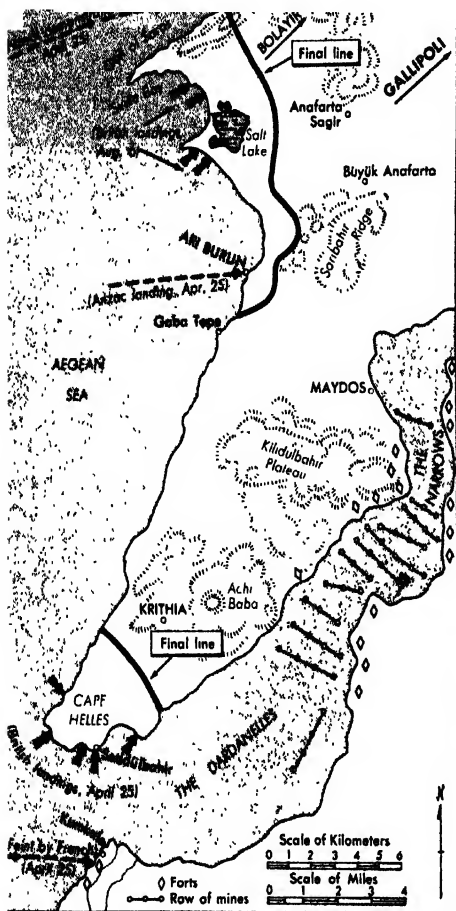
cause of the now inevitable collapse of the campaign in Gallipoli, on October 23 sent to the viceroy of India the following telegram: "Nixon may march on Baghdad if he is satisfied that the force he has available is sufficient for the operation." This put the blame for failure on Nixon, who was doubtful about the venture, and the credit for success on the government.

For the first time, the Indian troops, hitherto steady and reliable, showed signs of discouragement when they saw the heavily fortified position at Ctesiphon, only 20 miles southeast of Baghdad. The assault on November 22 was a complete failure and cost 4,500 casualties out of a total strength of 14,000. Townshend halted at Ctesiphon until his sick and wounded had been evacuated to Kut, but he followed them on December 3 and decided that he must stay there in view of the fatigue of his troops. He had a food supply which he reckoned would last two months and was confident of relief well within that time. The Turks soon followed Townshend and began the investment of Kut with the care which they always applied to siege warfare. It was small consolation that Baratov's Cossacks, sent by Grand Duke Nicholas to Persia after the victory of Karakilis, had reached Hamadan on December 14, since they were 230 miles from the scene of operations and were such a small and lightly armed force that they could have no effect on the campaign in Mesopotamia. Of greater interest was the report of the arrival in Baghdad of the veteran Gen. (Field Marshal in the Turkish Army) Baron Kolmar von der Goltz, the best pupil of Field Marshal Count Helmuth von Moltke. His reputation and his knowledge of Turkey were thoroughly established in the military world, and his British admirers took serious note of his advent, which was likely to make the relief of Kut still more difficult than they had expected. Almost simultaneously with Goltz' arrival, a Turkish commander named Halil Pasha also reached the Mesopotamian capital. He was a bold soldier, and the combination of experienced age and enterprising youth was likely to prove formidable.

The British and Indian governments had created their own difficulties. They had embraced them and the risks which they embodied in the hope of providing their own people and those sections of the Muslim world which backed them with a victory to counter the disaster of Gallipoli. In war, however, a clear purpose is an indispensable element of good strategy.

**Origins of the Campaign in Gallipoli, January-March 1915.**—On Jan. 2, 1915, a message from the Russian commander in chief, Grand Duke Nicholas, was delivered in London. Its contents may seem insignificant when it is considered how immense were the consequences, for it asked no more than that a demonstration be mounted against the Turks in order to induce them to withdraw troops from the Caucasus. Once the victory of Sarikamis had been won, however, the grand duke withdrew his plea, and it is certain that the Russian government would at that time have been sorry to see its allies in the Bosphorus. This does not alter the fact that the conception of the 1st Earl Kitchener, the secretary of state for war, and Winston Churchill, the first lord of the admiralty, to open communications with Russia by forcing a passage through the Dardanelles, was good strategy from the Russian point of view as well as from the British and French.

Before the land forces of the Allies reached the scene, their naval forces tried to do the job by themselves. The first efforts, from mid-February to mid-March, were on the whole successful; after the outer forts had been thoroughly pounded, landing parties were able to blow up the guns. The intermediate forts covering the Narrows were expected to be more difficult to reduce, but the naval commander, Rear Admiral Sir John de Robeck, and his staff officer, Comodore Roger J. B. (later 1st Baron) Keyes, were optimistic.



**GALLIPOLI CAMPAIGN, 1915.** On March 18, 1915, British and French naval units attempted to force their way through the Dardanelles, but withdrew after several battleships were lost in the minefields. On April 25, a well-planned amphibious Allied attack, accompanied by demonstrations and feints to deceive the Turks, was launched. Landings were made at Cape Helles and Ari Burnu, but the advance inland was stopped by the Turks after meager gains. In early August, a second attempt was made. The main landings in Suvla Bay were to be supported with offensives by the forces already ashore at Cape Helles and Ari Burnu. The Suvla Bay landing was a success, but the advance ashore was stopped after a gain of only a few miles. The supporting offensives at Cape Helles and Ari Burnu accomplished little. During the period Dec. 10, 1915-Jan. 9, 1916, the British and French completely evacuated the Gallipoli Peninsula.

It is still a moot point whether or not their optimism was justified. When the attack was made on March 18, a French battleship, a British battleship, and a British battle cruiser were sunk on a newly laid minefield that was undiscovered

and unswept; two other ships had to be beached, and a sixth was put out of action by the defense. On the other hand, it is now fairly well established that the Turks were at the end of their resistance, mainly for want of ammunition. Keyes sensed this and urged de Robeck to renew the attack, but the admiral understandably declined to do so in view of the terrible losses in ships and men already sustained. Gen. Sir Ian Hamilton, who had arrived in the area in advance of his troops, refused to advise a resumption of purely naval efforts for the same reason.

**Landings on the Gallipoli Peninsula, April-May 1915.**—The force made available to clear the way for the passage of the two navies consisted of four British divisions, including the Anzac (Australian-New Zealand) Corps, and one French division. The French were to make a feint landing on the Asian shore at Kumkale, where some thought the main operation should be conducted.

The Turkish commander, Liman von Sanders, had two more divisions than Hamilton had. He posted one at Cape Helles, the toe of the Gallipoli (Gelibolu) Peninsula; one at Maydos (now Eceabat), just north of the Narrows; two on the Asian side; and two at Bolayir (Bulair), 40 miles north of Helles at the narrowest point of the peninsula, where it was defended by the Bolayir lines. On the map this appeared to be the most favorable place for the main British landing, but Hamilton had ruled it out because of the strength of its fortifications. Hamilton had arranged that one of his assault divisions should demonstrate in front of Bolayir before being transferred to its next duty, and Liman von Sanders intended to send the two divisions there to Cape Helles or to any intermediate point on the peninsula where the need was urgent. It may thus be said that the two generals' conceptions of the right way to attack and hold the peninsula coincided and may be considered sound.

On the British side, the obverse to the potential advantages of the naval attack must be examined. The attack had put Liman von Sanders on the alert, which he cannot be said to have been before it. Much criticism was therefore directed at Churchill, the chief sponsor of the operation, and allegations that he ruined the chances of the expedition were often repeated in later years. In point of fact, Liman von Sanders was deceived by the spectacle of ships and landing craft lying off Bolayir on the morning of April 25. He mounted his horse, galloped up to the town, and spent the night there. The Russian Black Sea Fleet bombarded the Bosphorus forts and thus increased the illusion of an attack on Bolayir, though the bombardment was in fact a second example of the jealous policy of the Russian government where the straits were concerned. Russia was determined that if Constantinople were to be occupied by her allies, her troops should be on the spot. It was a junior Turkish divisional commander, Mustafa Kemal (later celebrated as Kemal Atatürk), who saved the situation by engaging his whole division without authorization against the Anzacs and holding the heights which were their objective.

The Helles landings were a tragedy. Of four landings, one was repulsed altogether after sickening slaughter in the sally ports of the *River Clyde*, a collier grounded to act as a landing ship, and one was abandoned in panic, but a firm foothold was secured eventually. In the Anzac landing an error in navigation put the troops a

mile north of the planned beach in an area backed by steep ridges, but the determined attackers fought their way into a defensible position. At home the reaction was the formation of a coalition government on May 25 and the removal of Churchill from the Admiralty two days later. Then the tide turned in favor of the campaign, which was strongly backed by the new government and was given priority over the western front for ammunition supplies. The Mediterranean Expeditionary Force was raised to a strength of 13 divisions, 2 of them French, against the 16 divisions of the expanded Turkish force.

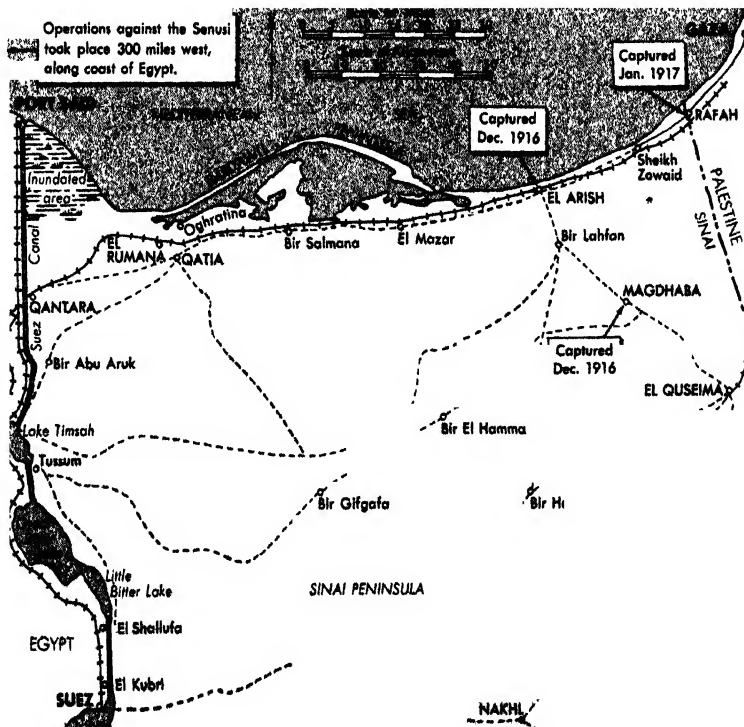
**Landings at Suvla Bay and Evacuation of Gallipoli, August 1915-January 1916.**—The new plan was to land two divisions at Suvla Bay; these were to surprise the enemy and then march eastward together with the Anzac Corps, thus cutting off the main Turkish force. The landings at Suvla on August 6 were virtually unopposed, but the initial advantages were wasted because of the inexperience of the troops, who indulged in picnics and bathing parties, and the inertia of the senior officers, including Hamilton. Liman von Sanders had ample time to move two divisions from Bolayir and repulse the attack. Despite great efforts made by supporters of the enterprise to keep it going, this was the end of the campaign. Kitchener visited the peninsula and cabled to London on November 22 that the Anzac and Suvla beachheads should be evacuated. Meanwhile, Hamilton had been ordered home. He was succeeded by Gen. Sir Charles Carmichael Monro, who had the over-all command at Gallipoli and Salonika, where a new campaign was beginning; Lt. Gen. (later Field Marshal) Sir William Riddell Birdwood, the Anzac Corps commander, was placed in command on the peninsula itself. The evacuation was completed when the rear guards were taken off early on December

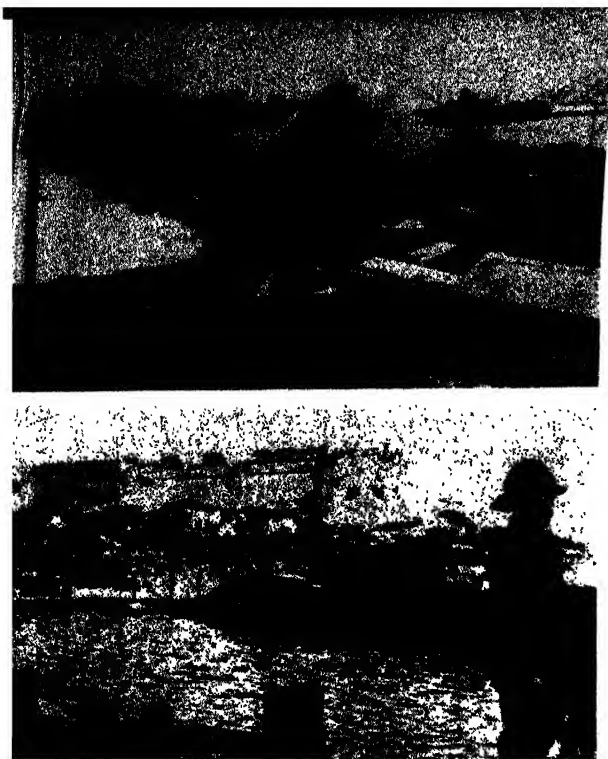
20 without the loss of a man. No such good fortune was expected at Helles, but the same result was achieved early on Jan. 9, 1916. For the entire campaign, the British alone had a casualty list of 214,000, a colossal figure.

It is safe to say that no other campaign was so ill conducted by Britain during the war. Each landing provided an admirable opportunity of securing the passage of the Dardanelles, and each opportunity was wasted. The final decision to withdraw was then inevitable for two reasons. First, the piers were too fragile to withstand winter gales. Secondly, German, Austrian, and Bulgarian forces had routed the Serbs, driving them from the Baghdad Railway, and enabling munitions to be delivered to the Turks in great quantities and at speed over a direct line.

**Campaigns Against the Senusi and in Sinai, 1915-1916.**—The British had won freedom of political action in Egypt in December 1914 by deposing the khedive, Abbas II Hilmi, an extreme pro-Turk who was living in Constantinople. He was succeeded by his uncle, Hussein Kamil, a moderate and sensible man who ascended the throne with the title of sultan, afterward changed to that of king. On Feb. 2, 1915, a Turkish force of 20,000 men under an able German officer, Col. (later Gen.) Baron Friedrich Kress von Kressenstein, approached the Suez Canal halfway between Lake Timsah and the Great Bitter Lake. Its march across the Sinai Peninsula had been in the best Turkish tradition, for the main body disdained the coast route and followed the almost waterless track through Nakhil, dragging pontoons through the deep sand. Three boatloads of soldiers actually crossed the canal, but the force was mercilessly pounded by British and French warships and had to withdraw by the way it had come. The British had not as yet assembled enough camels for a pursuit.

**CAMPAIGNS IN SINAI, 1915-1917.** In February 1915, the Turks attacked the Suez Canal in force and actually got some troops across, but they were finally driven back. After subduing an uprising of the Senusi in Egypt, the British began an advance through Sinai to the Palestine frontier. The rate of advance was governed by the progress of construction of a railroad and a water pipeline, needed to support the troops in the desert wastes. The British entered the desert in May 1916, brushed Turkish resistance and attacks aside at several points, and reached Rafah, on the Palestine border, in January 1917. They now prepared for operations against the Turkish stronghold at Gaza.





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Above: British supply base at Cape Helles, Gallipoli Peninsula, under Turkish artillery fire in 1915. On the left is the landing ship *River Clyde*. Below: Turkish forts at Seddülbahir, near Cape Helles, after they were occupied by British forces moving up the peninsula.

The evacuation of Gallipoli raised the question of whether it would further Turkish designs against Egypt. Some exaggerated estimates were made of the number of troops that could cross the desert, with the result that a major fortification of the canal was undertaken, and 14 divisions were assembled in an Imperial Strategic Reserve, which included divisions from France and the United Kingdom as well as those from Gallipoli. This force was speedily dispersed, however, 10 of the divisions having left Egypt by the middle of the year.

The chief activity in the Egyptian theater was that directed against the Nile Delta by Ahmad al-Sharif, head of the powerful sect of the Senusi (Sanūsī), with whom Enver Pasha's half brother, Nuri Bey, was residing. Ahmad gave the British of General Maxwell's command much trouble by his elusiveness, time after time escaping in a series of running fights. At the Battle of the Wadi Majid, fought on Christmas Day 1915, the skilled young Turkish commander of his forces, Jafar Pasha, put more than 2,500 men into action. At Halazin on Jan. 23, 1916, Jafar carried out a fine counterattack and inflicted more than 300 casualties on the small British force. At Agagiya on February 26, however, Jafar was wounded and captured, and without him Senusi activities declined almost to nothing. Maxwell, having completed his task of rendering Egypt secure from the west, returned to England. By this time, Lt. Gen. Sir Archibald Murray had taken over the bulk of the troops on the Suez Canal and in the Nile Delta. He now included under his authority all those in the theater of war, and the title of Mediterranean Expeditionary Force was

exchanged for that of Egyptian Expeditionary Force.

**Advance into Sinai, 1916.**—At the beginning of 1916 the command in Egypt was committed to an advance into Sinai toward the Palestinian frontier. The advance was to be extremely deliberate, being accompanied step by step by a railway and a pipeline to provide water, though General Murray's numerous yeomanry and Australian and New Zealand cavalry were expected to range ahead in order to protect the main body of troops and the Egyptian workmen against a surprise attack. In April, however, this screen was itself subjected to an attack by the enterprising Kress von Kressenstein, who secretly led a Turkish force of 3,500 men to the oases of Oghratina and Qatia and routed their garrisons.

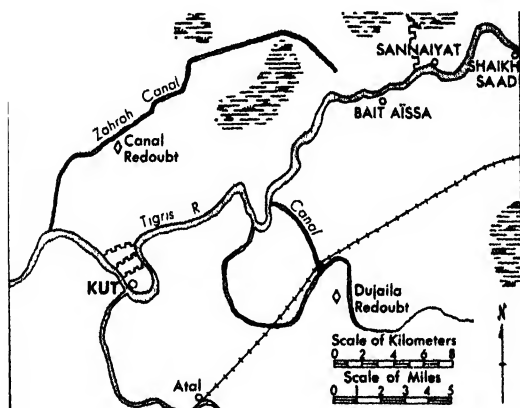
In the latter part of May, Murray moved an infantry division east to El Rumana (al-Rumanah; Romani), which was now established as the railhead, though the pipeline lagged behind. The division had to be supplied with water either by trucks from Qantara (al-Qantarah) on the Suez Canal or from the pipehead by camel convoy. Then the situation changed dramatically, for Kress was active again. On July 19, an aircraft discovered a force of about 2,500 Turks in a depression 20 miles southeast of the railhead; later, it was found that 16,000 men were on the march. These included the German personnel of four batteries and two trench mortar companies.

Murray could bring a considerable numerical superiority to bear—in fact, one measured almost entirely by the water supply, in which British needs were several times as large as those of the Turks. He realized at a glance that Kress would not dare to attack the railhead defenses frontally, and that, since the British left lay on the sea, he must try to envelop the right. This in its turn would afford an opportunity to take the Turks on their flank. To add to Kress' confusion, Murray proposed to establish a false flank. He was an experienced staff officer, and in the prewar period this type of defense had been emphasized in military training. A position four miles long was selected but left unvisited and untouched, except that telephone lines were laid down. Natural gullies in a patch of hard sand provided adequate defense. The false flank was entrusted to two brigades of the Australian Light Horse, with strong reserves behind it, and to this force was given the task of holding the Turks until they could be outflanked by the remainder of the mounted troops.

The Turkish attack was launched early on August 4, and it was soon evident that the Turks were not only fulfilling their destined role but doing it with great ardor and pluck. The situation of the cavalry became precarious, but frontal attacks on the defenses of El Rumana caused the British infantry no concern. Finally, as darkness gathered about 7 P.M., the reserves brought the enemy's advance to a halt. At daybreak on August 5, the British, including an infantry brigade, assaulted with bayonets. The brave Turkish rear guard was forced to surrender: 1,500 prisoners were taken, most of them in an agonizing condition for want of water. The mounted advance captured many more Turks, but its efforts soon slackened as the shortage of water affected it also and prostrated the majority of the troops. The morale of the main body of Turks never broke, but Turkish losses totaled 6,000 of whom 4,000 were prisoners, as against

a British casualty list of 1,130.

**Siege of Kut, 1916.**—There was small likelihood that the Turks would take Kut by assault so long as the British garrison could stand on its feet. The sack of the Tigris bend in which the town lies is less than two miles long and not much over a mile wide. After Townshend had fortified the open northwestern end of the sack with three lines of trenches, there was nothing left for him to do but send out his cavalry brigade before he was completely invested and await relief. The first attempt at relieving him, made by Lt. Gen. Sir Fenton John Aylmer in January 1916, was abortive, the Battle of Shaikh Sa'ad (Shaykh Sa'd) costing 6,000 casualties. Aylmer tried again in March, by which time the Turks were well dug in, and failed to take the Dujaila redoubt despite the gallantry with which his assaults were pressed, losing nearly 3,500 men, including 500 killed and 500 missing. By this time, Townshend had resolved to kill 1,100 horses and mules to keep the garrison alive.



**SIEGE OF KUT, 1916.** Three attempts were made to rescue Townshend and his British troops besieged in Kut. The first was turned back in an abortive battle at Shaikh Sa'ad. The second, in March, also failed. In April, a third attempt was made with some initial success, but it bogged down in front of the strong Turkish trenches at Sannaiyat. The British garrison of Kut surrendered on April 29, after having suffered great privations and many deaths.

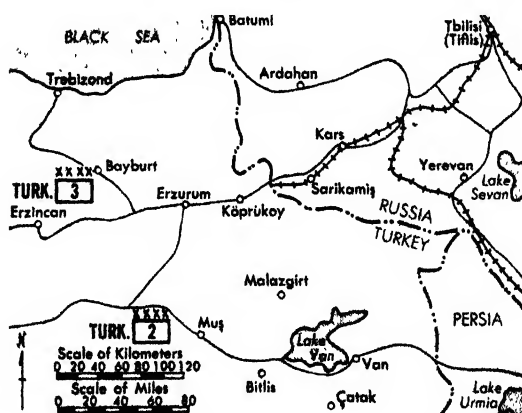
Aylmer was now succeeded by Gorringer, who in April was to make what was generally recognized as the final and decisive attempt at the relief of Kut. Acting with skill and vigor, Gorringer succeeded in breaking the Turkish front at Bait Aissa on the right bank, and hopes of relief soared. This, however, entailed another assault on the left bank and penetration at Sannaiyat of a heavily fortified gap between the Tigris and a marsh. On April 22, Gorringer made the attempt, was repulsed, and reported that his troops had for the time being reached the end of their offensive powers. Lord Kitchener then authorized the command to open negotiations for surrender. These were carried out by Townshend and Halil in a Turkish launch, and the surrender took place on April 29. Goltz had died of cholera on April 19, but not before he knew that Kut was doomed to fall. The prisoners were barbarously treated, being flogged across the desert by their mounted escort. The people of England took the catastrophe hardly, but it had curiously little effect in the Arab lands.

In August, Gen. Sir Frederick Stanley Maude succeeded Lt. Gen. Sir Percy H. N. Lake, who

had only six months earlier succeeded Nixon. Maude was a strong advocate of a forward policy and won the support of General Monro, who visited him en route to take up his new appointment as commander in chief in India. The war cabinet took the two generals' side against that of the War Office, but the latter then withdrew control of the Mesopotamian campaign from India and assumed it itself. Maude now had five divisions at his disposal, four of them in two corps on the Tigris and the fifth on the Euphrates. He was by far the best soldier engaged in this hitherto luckless theater, but his resources were also much superior to those of his predecessors. Including cavalry and troops on the lines of communication, his forces totaled 340,000 men, although only 166,000 of them were fighting troops (107,000 Indian and the remainder British). Turkish fighting strength was estimated at 42,000, half that number being stationed on the Tigris and the remainder on the Euphrates and at Baghdad. The Turkish Sixth Army was riddled with disease, and reinforcements never equaled the wastage from this source plus the battle casualties. Nevertheless, the Turkish soldier was nearly as formidable as ever in a prepared position, and unless he could be maneuvered from it, gains could be secured only at great cost. Maude began his advance northward on December 13.

**Operations in the Caucasus, 1916.**—The destination of the Turkish divisions which had fought on the Gallipoli Peninsula was a source of anxiety to the Russian General Staff early in 1916. It was to be expected that a fair number would be dispatched to Syria and Mesopotamia and a few to Europe, but a majority would certainly be moved eastward in Asia Minor against the forces under the command of Grand Duke Nicholas. A Russian defeat there might be deadly, though it did not count as a main theater of war.

The grand duke, formerly the Russian commander in chief, was playing a minor part now as viceroy of Transcaucasia. His subordinate, General Yudenich, studied the problem of the Gallipoli divisions in detail and concluded that



**OPERATIONS IN THE CAUCASUS, 1916.** Anticipating that the Turks would take the offensive in the Caucasus with the troops released by the British evacuation of Gallipoli, the Russians struck first. In January, they took Köprüköy; in February, Erzurum; and in April, Trabizond. The Turkish Gallipoli divisions tried to recapture Erzurum in May and Trabizond in June, but without success. The Russians continued their advance, capturing both Bayburt and Erzincan in July, practically destroying the Turkish Third Army in the process. To the south, the Turkish Second Army took Mus and Bitlis in mid-August, but the Russians turned the two towns a week later.



none of these forces was likely to appear before late March. The Russians should therefore anticipate the Turkish offensive, which would inevitably be launched as soon as possible after that. Yudenich prepared his plan and its material components, and only after that had been accomplished went to Tbilisi to lay them before his chief. Yet the grand duke could never be a cipher, and with any lieutenant but Yudenich he would have intervened far more comprehensively.

The latter must have recalled the Battle of Sarikamis, fought at the same time of year as that in which he now proposed to attack. He provided his troops with fur caps, thick shirts, and felt boots for marching in the snow. His offensive at Köprükoy on January 17 took the Turks by surprise and, though complete envelopment failed, forced Abdul Kerim into retreat at the best pace he could muster with a loss of about 25,000 men, largely from frostbite.

On February 12-16, Yudenich exhibited great skill and daring in storming Erzurum, a notable feat for an army without siege artillery, by his swift infiltration between the forts. Simultaneously, he sent General Lyakhov westward along the coast in a combined operation with the Black Sea Fleet against Trebizond (Trabzon). By systematically bombarding the steep valleys running down to the shore and conveying two brigades from Novorossisk, the fleet put Lyakhov into the best roadstead on the north Anatolian coast on April 17.

Meanwhile, Enver made ambitious plans for the Gallipoli divisions, which were to engage the Russians on a wide front south of the Black Sea and simultaneously to turn their flank at Bitlis, near Lake Van. Yudenich did not want to await the attack passively, but in view of the enemy's superior strength he had to choose his opportunities carefully. At the end of May, without awaiting the arrival of the bulk of the reinforcements on their way, the Turkish Third Army attacked west of Erzurum, but its offensive soon collapsed. In June, Enver, angry that the Russians should retain Trebizond, to which they were steadily sending troops, ordered its recapture, but once more his lieutenant failed him.

Meanwhile, Yudenich had completed his deliberate preparations. His main blow, on July 2, was struck through Bayburt, located south-southeast of Trebizond at the apex of a triangle of which the base ran from Erzurum to Erzincan. As was his general practice in this country of few roads, he planned to split the enemy's front and not to turn his flank. The shock was tremendous and led to a crushing Russian victory and the capture of the road center of Erzincan on July 25. Harried by the Cossacks, the Third Army was removed from the war. It had lost 17,000 men in killed and a like number in prisoners taken by the Russians. To these figures must be added an unknown number of deserters who had settled in the villages. On the Turkish right wing, the Second Army did not launch its attack until it had received all the reinforcements allotted to it, but also not until Yudenich had been able to send southward troops that had fulfilled their mission at Erzurum. While this attack achieved some success, the only sector where it could be said to have been substantial was on the right flank, where Mustafa Kemal, now a corps commander, captured Muş and Bitlis on August 15. Kemal's achievement showed what a fine commander could do at the head of a sea-

soned, well-trained army, proud of its victory at Gallipoli, but even the very moderate army commanders employed in Asia Minor might have accomplished much more if they had been placed under any commander but Enver. In any case, Yudenich was able to recapture Muş and Bitlis on August 24.

**Arab Revolt and Campaign on the Palestinian Frontier, 1916-1917.**—On June 5, 1916, Sherif Husayn (Hussein), ruler of the Hejaz under Turkish control, began a successful revolt against his overlords, and on June 10, after three days' street fighting, captured the summer garrison at Mecca (Makkah). He next turned his attention to Taif (al-Ta'if), where the main body of the Hejaz garrison was installed according to custom and, with the aid of two Egyptian mountain batteries under their own Muslim officers, forced it to surrender. This time the Arab commander was Husayn's second son, 'Abdullah, later emir of Transjordan and king of Jordan. By then the Arabs had captured more than 5,000 prisoners, but this was the last of their good fortune for a long time. Faysal, Husayn's third son, failed completely in an attempt to capture Medina (al-Madinah), which was held by the Turks until the end of the war. The British had prepared trouble for themselves by the secret Sykes-Picot agreement of May 16, which allotted Syrian territory to France without regard to British pledges to Husayn. It was a case of the left hand, Sir Mark Sykes, not knowing what the right hand, Lord Kitchener, had promised the Arabs.

By December 1916, the British forces in Sinai had reached the neighborhood of El Arish (al-'Arish), 27 miles from the frontier of Palestine. Murray was being urged by Prime Minister David Lloyd George, through the medium of the doubting chief of the Imperial General Staff, Gen. (later Field Marshal) Sir William Robertson, to invade Palestine as soon as possible, a task for which he did not believe he had the necessary strength. Nevertheless, after occupying El Arish on December 21, he cleared out the two Turkish outposts south of the frontier. The first was Magdhaba, where, on December 23, 1,300 prisoners were taken for a British loss of 146, and only a handful of the garrison escaped. The second was Rafah, which was captured on Jan. 9, 1917, by five brigades of light horse, yeomanry, and camelry, after a much more fiercely contested struggle. This time the number of prisoners was a little larger, 1,600, but the British losses were not far short of 500.

**Capture of Baghdad, 1917.**—General Maude's orders to capture Baghdad depended for their fulfillment on supply. In this he was fortunate because he had been provided with 45 (later 64) river craft, but it was not until March 1917 that he considered himself able to furnish support for four infantry divisions and a cavalry division of two brigades as far north as Baghdad. Meanwhile, beginning on January 9, he was engaged in hard-fought actions as a result of which Kut changed hands for the third time. As in 1916, Sannaiyat proved difficult to take, and Maude's assault on February 17 was thrown back in disorder, but this mishap was repaired five days later. On February 25, Kut was found deserted and in ruins.

Maude pressed on at high speed, but had to make a brief halt at Al 'Aziziya. He estimated the Turkish force in the whole theater at about 35,000, as against his own fighting strength of

120,000. The next Turkish stand was made on the Diyala River, which enters the Tigris 10 miles below Baghdad. Maude, whose land artillery was admirably seconded by the Royal Flying Corps and a flotilla of gunboats, laid down a crushing bombardment on the enemy's position. Under its cover he established a pontoon bridge and passed his two brigades of cavalry and a strong force of infantry over to the left bank. Thus outflanked, the enemy was unable to withstand the shock of his attack on the Diyala and abandoned Baghdad. Maude entered the city on March 11. This time he took 9,000 prisoners.

Halil Pasha, who had creditably held together his weary, sick, and underfed army, led it to a strong position 50 miles above Baghdad, with its right flank bent forward to Ramadi (Rumadiyah). He had received two more divisions of 7,000 men each, but his forces were perilously strung out, his left facing on the Persian frontier a Russian force inclined to break up as a result of the revolution. Maude had still to consider whether any substantial additional forces of Yilderim (Lightning) troops would reach the scene, but that danger passed, and he had been promised two more divisions from India. In any case, he did not intend to move while the baking summer heat lasted.

On November 18, less than two months after an impressive victory at Ramadi (September 29), in which the majority of the garrison was captured, the commander in chief died in the house in Baghdad which had seen the end of Goltz, and like him of cholera. Maude's death came as a shock to the people of Britain, for whom he had become by far the most popular soldier of the war. In the first place, he had transformed the life of the troops with the aid of supplies from home and of the work of a remarkable administrative officer, Maj. Gen. Sir George Fletcher MacMunn. Chicken farms and kitchen gardens provided fresh eggs and fresh vegetables to supplement the abundant local fruit, and chilled meat became plentiful even for troops in the front line. Electric fans were installed in the hospitals. Secondly, Maude had wiped out the shame of the 1916 surrender at Kut. He was succeeded by his senior corps commander, Lt. Gen. Sir William Raine Marshall, who made a good start by driving the Turks out of Khanaqin on December 9.

General Robertson was, however, no better pleased with the prospects than before. He had divined that Mesopotamia was becoming more and more of a political theater. The oil wells to the north attracted the British government, somewhat to the chagrin of the French, who saw no such interesting prospects for themselves and considered that Britain was failing to do her share. Late in 1917, Robertson had Marshall's best Indian division transferred to Allenby's command in Palestine, where he felt it would find more useful occupation.

**First Battle of Gaza, March 1917.**—In the spring of 1917, General Murray, though deprived of one of his four divisions, was directed to invade Palestine, starting with the capture of Gaza. His chief subordinate was now Maj. Gen. Sir Charles Macpherson Dobell, to whom he delegated the operation in its entirety. Dobell decided to form a wide screen of mounted troops, in which he was exceptionally strong, to hold off outside Turkish intervention, and within it to storm the town from the south. As in previous

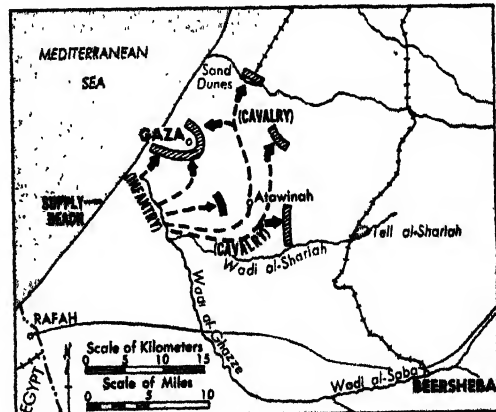


Imperial War Museum, London  
A detachment of Indian troops under the command of Gen. Sir Frederick Stanley Maude halts in New Street, Baghdad. The city was taken on March 11, 1917, after it had been abandoned by the retreating Turks.

campaigns, the key to the situation was the water supply, for it was doubtful whether Maj. Gen. Sir Philip Walhouse Chetwode's cavalry force of two divisions, known as the Desert Column, could water horses numbering more than 10,000 anywhere except at the wells of Gaza.

The starting line was the bed of the Wadi al-Ghazze, now nearly dry, from a point six miles south of the town. Gaza was a very formidable objective. Although the garrison totaled only about 4,000 men, and few trenches had been dug, dense and virtually indestructible cactus hedges thick with thorns made the town a natural fortress.

On the morning of the attack, March 26, there was a very heavy fog, but it did not seriously interrupt the envelopment of Gaza by the mounted troops, who used compass bearings. In general, the infantry also defied the fog and made



**FIRST BATTLE OF GAZA (March 1917).** As an initial step in the invasion of Palestine, the British attempted to drive the Turks from their positions at Gaza. The town itself was a veritable fortress. Reliance was placed on the cavalry to isolate the town while the infantry assaulted and carried its defenses. Just as success was within reach, the cavalry was recalled through poor staff work, and the battle was called off.

satisfactory progress, gallantly capturing strong positions on the ridges three miles south of the town.

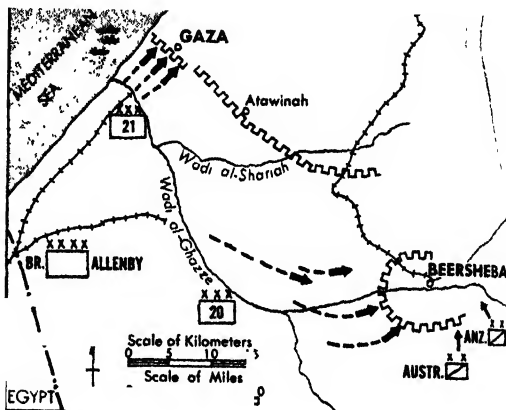
The rest of the battle was badly managed. The cavalry was ordered to withdraw for lack of water at a time when it had actually found some fair-sized pools and had watered a number of its horses. The crowning positions just captured were abandoned because of an error by Chetwode's staff, and though they were retaken the next day by a fine attack carried out by tired troops, the success came too late. The mounted troops and the right flank of the infantry were pressed sharply by the force driven westward by Kress von Kressenstein. To cap the confusion, Murray sent a misleading telegram to the chief of the Imperial General Staff, hoping to be able to repair the situation before his superiors learned of the reverse. Robertson naturally urged him to make a fresh effort. The British losses were 4,000, and the Turkish 2,400.

**Second Battle of Gaza, April 1917.**—The situation was now entirely different because the Turks had deployed and dug themselves in along the Gaza-Beersheba road. General Dobell, again left largely uncontrolled by Murray, decided to attack this new position mainly with a single division on a two-mile front beginning two miles southwest of Gaza. He was asking a great deal of his troops, for the gentle ascent there was a veritable glacis. Despite the dauntless courage with which the attack was conducted on April 17–19, it was a complete failure, costing 6,500 British casualties as against 2,000 Turkish. This disparity was too great for Lloyd George and Robertson, though they may not have realized the fact that Murray had remained aloof from responsibility to the extent that his headquarters had become merely a military secretariat. They recalled Murray in June and sent in his place Gen. Sir Edmund Allenby (later 1st Viscount Allenby), hitherto commanding the Third Army in France.

Allenby, known as "the Bull" because of his height, bulk, and explosive temper, was welcomed even by the very democratic Australians and quickly restored the morale of a depressed army. In such circumstances, a new commander immediately demands reinforcements and gets them. Two divisions were forming in the coun-

try from dismounted yeomanry units which had served in the Gallipoli campaign and from other troops available. Two more divisions from Macedonia and Mesopotamia raised Allenby's total strength from three to seven divisions, and he formed two corps, commanded respectively by Chetwode and Lt. Gen. (later Sir) Edward Bulfin.

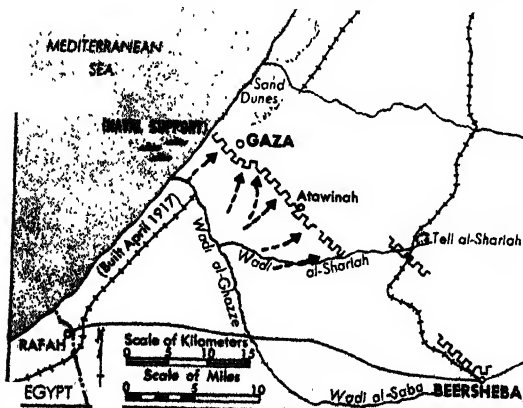
**Third Battle of Gaza and Advance into Palestine, October–December 1917.**—Allenby's plan was to attack both at Gaza and at Beersheba. The attack at Gaza was to be a holding operation, while Beersheba and its vital wells were to be captured from the east by Australians and New Zealanders with the aid of two infantry divisions attacking from the west. The whole Turkish front along the road to Gaza was then to be rolled up. For the Gaza attack, Allenby was sent eight tanks, the only ones used outside France in the war.



**THIRD BATTLE OF GAZA (Oct.–Nov. 1917).** Heavily reinforced, the British, under Gen. Sir Edmund Allenby, again attacked the Turkish Gaza position. The initial attack was made against Beersheba, to capture the water wells and, from there, to roll up the Turkish line. The Beersheba attack was successful, and Allenby now struck directly at Gaza, supported by naval gunfire. The Turkish defenses were overpowered, and Gaza captured on November 7.

In the attack on Beersheba on October 31, Allenby had unmerited good fortune. Everything hinged on capturing the wells intact, for without them the cavalry would have to withdraw. In a prolonged fight the local Turkish command had ample time to destroy the wells but failed to do so. Thus the rolling-up process could begin in good time, and it proved most successful. The same could not be said of the exploitation of the cavalry, which was not concentrated quickly enough, although it did inflict heavy losses on the enemy. Allenby now turned his efforts to the coast, made the Gaza feint the real attack, broke through the Turkish defenses with the powerful aid of British and French naval guns, and thrust northward up the coastal plain. Gaza was occupied on November 7, and Jaffa on November 16.

Meanwhile, a grandiose project fathered by Enver, to send a Turkish army of 14 divisions and 6,000 German troops under Gen. Erich von Falkenhayn to retake Baghdad, had proved impracticable because of the impossibility of transporting such a force to Mesopotamia or of feeding it if got there. Falkenhayn himself hurried to Palestine, and the first of the Yildirim divisions arrived in time to take part in the Battle of Gaza.



**SECOND BATTLE OF GAZA (April 1917).** In April, the British launched another attack against the Turks at Gaza. By now the Turks had strongly entrenched their position from Gaza to Beersheba. The British attack, delivered directly against the trenches, was driven back.

Falkenhayn missed no opportunity of harassing Allenby's open flank, but he lacked the strength to do more.

The German general gave more trouble when Allenby wheeled into the Judaeian Hills, launching a number of successful counterattacks and blocking the British project. By Allenby's direction, Bulfin had made his thrust seven miles north of Jerusalem in order to avoid the risk of damage to the Holy City, but the commander in chief could no longer maintain this policy. He brought up Chetwode's corps for a direct drive across the Jaffa road, and after very hard fighting received on December 9 the surrender of Jerusalem, which had been handed over to the municipal authorities by the Turks. Allenby made his entry on December 11, on foot and with the greatest modesty, in accordance with instructions from Lloyd George.

Falkenhayn made an attempt to recover Jerusalem on December 28-30. The Turks once more gave of their best, but the venture was hopeless in the face of Chetwode's strength and preparedness; in fact, Chetwode counterattacked and drove the enemy back to the safe distance of eight miles from Jerusalem. The victory was complete but costly. Turkish losses in the campaign to date were approximately 25,000, of whom 12,000 were prisoners of war. The losses of the Egyptian Expeditionary Force totaled 18,000.

The activities of the Arabs were not of major importance during 1917, but they strained Turkish resources by means of raids on the Hejaz Railway and held out great promise for the future. They had been enlivened by the influence and exploits of an extraordinary young genius, T. E. Lawrence, who was consistently supported by both Murray and Allenby. Lawrence allied himself in particular with Husayn's son Faysal.

**End of the War in the Caucasus, 1917-1918.**—The campaigns of Yudenich and his hard-fighting troops in the Caucasus ended tragically. On the whole, these forces, especially the Armenians, resisted the summons of Vladimir Lenin and Leon Trotsky to return to their homes rather more strongly than did the troops on the eastern front. Nevertheless, the command was quickly paralyzed by insubordination, and soon it and the hierarchy of officers lost all authority. The Cossacks led the rush back to the farms, which were, as they believed erroneously, to become their personal property as free peasants. Yudenich also went home and later distinguished himself in the civil war.

The Turks now enjoyed a favorable situation, which was to continue until the autumn of 1918, when their collapse in Syria and that of the Germans on the western front reversed it. They had already perpetrated abominable massacres of the Armenians while engaged in fighting the Russians in 1915, and now the massacres were resumed. Estimates of the number of Armenians who were killed or died of starvation during the war vary, but the deaths amounted to at least half a million. In addition, the lives of such communities as the Georgians were gravely disrupted.

**Palestine, Transjordan, and Syria, 1918.**—Immediately after the operations for the capture and consolidation of the Jerusalem-Jaffa line, Palestine suffered unusually heavy rains and floods, which delayed Allenby's contemplated advance. In March 1918, he did carry out a large-scale operation, which he considered promising, for the destruction of the Hejaz Railway at Am-



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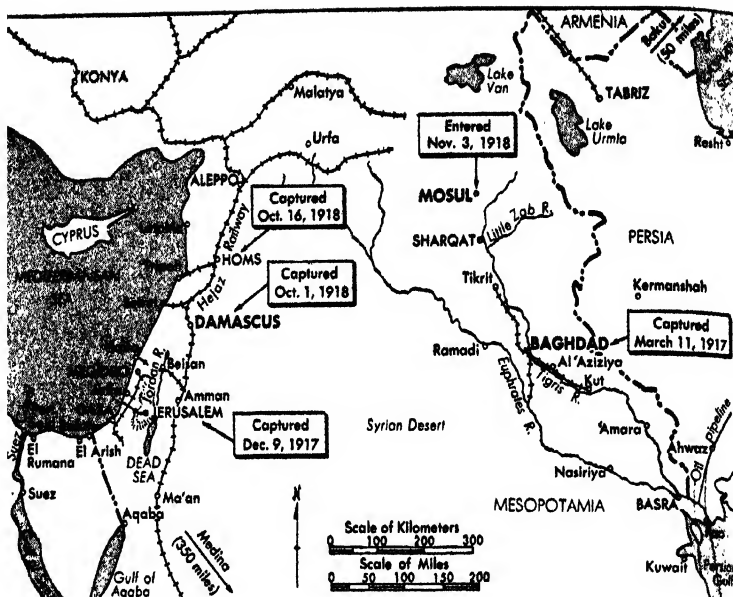
Gen. Sir Edmund Allenby, accompanied by Allied officers, enters Jerusalem by the Jaffa Gate on Dec. 11, 1917.

man ('Amman). The operation was in many respects well conducted, and on March 30 the town was ringed on all sides but the east. The attacking force was not strong enough to tip the balance, however, and in the afternoon orders were issued for a general withdrawal after trifling damage had been done to the railway. The great viaduct, which had been the principal objective, had not been reached. A second raid into Transjordan was nullified on April 11 by a brilliant counterattack across the British communications in the Jordan Valley in which the Australians lost nine guns. The perilous retreat to Palestine was safely accomplished.

By this time the great German offensive of March 21 had been launched on the western front. The War Office, spurred by a sense of guilt at having left too many first-class troops in Palestine, recalled all that it safely could. In April, the Lys offensive led to further demands. Allenby's Yeomanry Mounted Division was reconstituted with Indian regiments from the Indian cavalry divisions in France, and they sufficed with the yeomanry to form an entirely new cavalry division, of which he now had four. In all, Allenby sent to France two infantry divisions, nine yeomanry regiments, 23 infantry battalions, and some heavy artillery, aggregating almost 60,000 men. He retained four cavalry and seven infantry divisions, including a second division from Mesopotamia, but most of the Indian troops were raw.

The Turks, in addition to a German contingent represented by a small but heavily armed division, had received some reinforcements, but they never attained a strength of 30,000 even if the troops on the Hejaz Railway north of Ma'an were included, whereas the British forces were well over twice as large. They had a new commander in chief in Liman von Sanders, who had replaced Falkenhayn in March. The change in

**THE TURKISH COLLAPSE, 1918. Palestine.**—After the capture of Jerusalem in December 1917, the British conducted unsuccessful operations against the Hejaz Railway until March 1918. Then many of the troops were transferred to the western front to help stem the German offensives. Operations in Palestine were resumed in September 1918, when the British routed the Turks in the Battle of Megiddo, bringing their forces to the point of disintegration. The British pressed the pursuit, captured Damascus on October 1, Homs on October 16, and continued northward until the armistice on October 31. **Mesopotamia.**—Concurrently with the drive in Palestine, the British advanced from their base at Baghdad, forced the surrender of the Turks on their front in the Battle of Sharqat, and entered Mosul on November 3 (the last Turks left the city on November 10).



leaders brought about a change in strategy and major tactics, from defense by maneuver to defense by resistance in trenches.

Meanwhile, the exploits of Lawrence, now a major, had been outstanding. Perhaps the high point was reached at Tafla (al-Taflah) in southern Transjordan, which may be described as a classic operation. Falkenhayn had sent two strong columns which compelled the Arabs to evacuate the village, but in the end it remained in their possession after changing hands five times. Allenby's aid was generous. The Arab Northern Army, which now included small regular sections, was the nucleus of a far larger force of Bedouins and villagers who could be called out as needed. The attacks on the Hejaz Railway were increased until Medina was cut off because the supply of spare rails had been exhausted.

Allenby's plan was to mass his infantry in the coastal plain, wheel to the right, and open a gate for his Desert Mounted Corps of three cavalry divisions. The assault in what became known as the Battle of Megiddo began on September 19. Here and there Turkish resistance was determined, but demoralization soon appeared, and the gate was open. Bombing by aircraft was highly effective, blocking traffic for long periods. The two leading cavalry divisions went forward at 7 A.M. One, emerging the next morning into the plain of Esdraelon (Jezreel), reached the Jordan at Beisan (now Beit-Sh'an), having covered 70 miles in 34 hours. The other entered Nazareth and just missed capturing Liman von Sanders. Lawrence and his Arabs took Der'a at the junction of the Palestinian railways and the Hejaz line, and the Australians and New Zealanders captured Amman and blocked the Turkish Fourth Army, taking 10,000 prisoners.

Damascus was reached by the Desert Mounted Corps on October 1, and Homs (Hims) by the 5th Cavalry Division on October 18. The latter then went on alone because the 4th Cavalry Division was prostrated by malaria and influenza, and a last action was fought at Haritan on Oc-

tober 26 before news arrived that an armistice had been concluded with Turkey. The 5th Cavalry Division had marched 550 miles in 38 days. Allenby took 75,000 prisoners, while British losses amounted to a little more than 5,600. A plan of genius involving great risks for the cavalry, which had to live on a denuded countryside, had ended with one of the most crushing victories of modern times.

**Advance to Mosul, 1918.**—Gen. (later Field Marshal) Sir Henry Wilson, who had succeeded Robertson as chief of staff in February 1918, was inclined to subordinate military considerations to political ends. These included saving Georgia, Russian Armenia, and Russian Azerbaïdzhan from the Turks and Germans, and securing the oilfields of Mosul. General Marshall, having lost two divisions to Allenby, had a difficult problem to face when he was ordered by Wilson to begin his advance up the Tigris. He allotted to the operation a corps under the command of Lt. Gen. Sir Alexander Stanhope Cobbe. At first there seemed to be no great necessity for haste, but in mid-October the Turks secured the good offices of Spain in approaching President Woodrow Wilson in their quest for peace. The fact that they were seeking an armistice made Mosul more attractive than ever and spurred Henry Wilson and his political masters to establish a *fait accompli* in the eyes of the world. In the Balkans, after Gen. Louis Franchet d'Espèrey's crushing victory in Macedonia in September and his advance to the Danube, the British commander, Gen. Sir George Francis Milne (later 1st Baron Milne), had wheeled right to the Turkish frontier on the Maritsa River, but there had been no further fighting. Turkish plenipotentiaries reached Mytilene, Lesbos, on October 20, and from then on Marshall advanced as fast as he could, starting on October 23. Ismail Hakki, commanding the Turkish Tigris Group, withdrew to the Little Zab River, a tributary of the Tigris 50 miles to the north.

Marshall pursued the Turks at great speed, and his leading cavalry brigade, covering 77



miles in 39 hours, forded the Little Zab. Ismail Hakki maneuvered neatly to face the threat to his flank, withdrawing all troops on the left bank to the right and dismantling his pontoon bridge, but he was given no respite. On October 26, the British brigade discovered another ford over the Tigris 30 miles farther north and came down in the enemy's rear; the next day, Hakki retired to a position 5 miles north of Sharqat (Qal'a Sharqat). While the British main body was closing on him, the cavalry brigade found itself in a perilous situation, but, having been reinforced by the remainder of its division and some infantry, held its own in heavy fighting.

The Battle of Sharqat was fought on October 29, and though the infantry failed to break through, the Turkish commander realized that he was in a hopeless situation and surrendered early the next morning, having lost 11,300 prisoners and 51 guns, whereas the British loss was only 1,886. The armistice signed in the *Agamemnon* in the harbor of Mudros (now Moudros), Lemnos, on October 30, came into operation the following day.

The Indian cavalry division was ordered to take Mosul as soon as possible, relying on local resources for food and fodder, and it reached a position 12 miles south of the city on the evening of November 1. After much haggling, the Turkish government was told that if it would withdraw without making further difficulties, the British government would refrain from demanding its surrender under a clause in the armistice which stipulated that all garrisons in Mesopotamia must lay down their arms. Halil Pasha, commanding the Sixth Army, protested that the remnant of the army was not a garrison but a field force, but he gave way in the end. The British entered Mosul and installed themselves firmly on the Caspian Sea, reoccupying Baku, which they had formerly held with a token force in aid of the Russian garrison, but from which they had been compelled to withdraw because their allies fled whenever the Turks attacked.

The campaigns in Mesopotamia cost Britain and India 92,500 men, of whom 18,620 were killed or died of disease. It would seem that the oil wells and pipelines might have been more economically safeguarded. From another aspect, Mesopotamia does credit to the United Kingdom and India. Except for the Russian operations in the Caucasus, they bore the weight of the war with Turkey, a stupendous burden in view of the British effort on the western front, at sea, and in the air.

See also sections 12. *Balkan Campaigns*, 13. *The War at Sea—Dardanelles Campaign*, and 15. *Diplomatic History of the War*; ANZAC; ARMENIA; MIDDLE EAST—5. *History* (Modernization); PALESTINE—*History* (Palestine During World War I); SYRIA—9. *History* (Modern); TURKEY—*History*.

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## 12. Balkan Campaigns

Major European powers had direct interests in the Balkan states in the period before World War I. Austria-Hungary, having absorbed the former Turkish provinces of Bosnia and Herzegovina in 1908, had visions of further expansion to the south. Russia, self-appointed guardian of "her

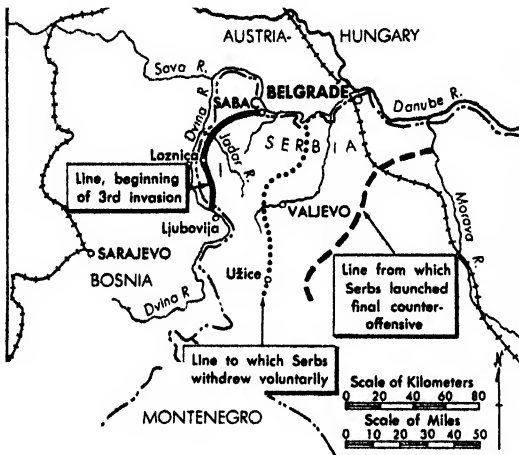
little Slavic sisters," feared an Austrian advance to the Dardanelles. Germany needed access to the sections of the Baghdad Railway (q.v.) running through Serbia and Bulgaria to join forces with her Turkish ally. In the Balkan states themselves feelings of nationalism were strong, and the desire to merge similar ethnic groups and the claims to adjacent provinces bred bitter hatreds. It was inevitable that, when Austria-Hungary set out to punish her troublesome little neighbor Serbia, all of the Balkan states would become embroiled.

In summary, three Austrian offensives against Serbia in 1914 were thrown back by the brave Serbs, but no further action of importance took place there until October 1915. Then, as the German need for the Baghdad Railway became acute and Serbia stubbornly denied passage through her territory, German, Austrian, and Bulgarian troops in superior numbers overran Serbia and her stanch ally Montenegro. (Bulgaria, finding the offers of the Central Powers more attractive than those of the Allies, had joined the former on October 14.) In an attempt to help Serbia, the Allies established a front in Greece based on Salonika, but it had not grown sufficiently in time to render material aid. The Greek government wavered between a pro-Ally and a pro-German attitude according to whether Premier Eleutherios Venizelos or King Constantine I wielded power. Finally, in June 1917, the pro-German king was forced to abdicate, and Greece joined the Allies. Rumania weighed the offers of both sides and waited for a propitious time to join the winning side. Although she chose the eventual winner, she timed her entrance poorly. Entering the war in August 1916, she was promptly crushed by an avalanche of German, Austrian, Bulgarian, and Turkish troops before the Allies could help her. Finally, in September 1918, when the Germans' efforts were concentrated on their collapsing western front and Austria was fully occupied in Italy, the greatly enlarged Allied Salonika armies came to life and moved against isolated Bulgaria, forcing her to seek an armistice.

**Austrian Invasions of Serbia, 1914.**—With a neutral Bulgaria on Serbia's eastern border, the Austrians could attack Serbia only from the north and west in 1914. There they were confronted by the Danube, Sava, and Drina rivers, which were wide and unfordable. Behind the rivers mountain ranges presented formidable obstacles to offensive military operations. Austria-Hungary possessed an overwhelming superiority in manpower, and the Serbs realized that they would have to fight a defensive war until the Allies could come to their aid. Gen. Radomir Putnik, the Serbian military commander, therefore planned to hold the river lines at the border with outposts while he concentrated his main forces in a central position just east of Valjevo. When the direction of the main Austrian attacks became known, he could meet them with most of his strength. Although his troops were woefully weak in automatic weapons, artillery, and transport, most of them were veterans of the Balkan Wars of 1912–1913 and were hardy and determined individuals.

On August 12, three Austrian armies, totaling 19 divisions, began their invasion—the Second Army from the north, and the Fifth and Sixth armies from the west. To meet them, Putnik had 12.5 divisions organized into three small armies

and totaling about 200,000 men. One corps of the Austrian Second Army quickly captured Sabac (Shabats), and by August 15 the Fifth Army had pushed its way against stubborn resistance to the Jadar River. The next day, Putnik launched a strong counterattack that drove the Austrians back across the border. The Austrians contributed substantially to their own defeat: Gen. Oskar von Potiorek failed to coordinate and direct the operations properly, and the brunt of the invasion was borne by only 8 of the available 19 divisions. Moreover, the Austrians underestimated the speed of the Russian advance in Galicia and were forced to draw first half and then all of the Second Army from the Serbian front to counter the Russians.



**AUSTRIAN INVASIONS OF SERBIA, 1914.** At the outbreak of war, Austria proceeded immediately to punish Serbia. Three invasions were launched in rapid succession. In the first, the Jadar River was reached, but the offensive was mismanaged and the Austrians were driven back across the border. The second invasion was promptly halted by a strong Serbian counterattack; the Austrians, however, retained a foothold in Serbia. The Serbs then withdrew to better terrain and braced themselves for the third offensive. They were forced to give ground, but eventually counterattacked with determination and again expelled the Austrians from Serbia. Threatened by the Russians in Galicia, the Austrians suspended operations against the Serbs.

On September 8, Potiorek launched a second invasion across the Drina and Sava. Initial gains were made, but on September 16 a strong Serbian counterattack brought the invasion to a halt. The Austrians were not completely expelled from Serbia, however, and retained bridgeheads on both rivers. With his forces extended and short of artillery and munitions, Putnik withdrew to higher ground on a line running north and south through Valjevo.

On November 5, Potiorek began his third invasion. By November 15, Valjevo had been captured; by November 29, Belgrade had been evacuated, and the Serbian armies pushed 20 miles east of Valjevo. Inspired by an appeal from old King Peter I, who appeared at the front with his rifle and bandolier of ammunition, the three Serbian armies counterattacked fiercely on December 3. By December 9, the Austrians were so hard pressed that Potiorek ordered a retreat. The last of the invaders withdrew across the border on December 15. Nurtured by hatred, the fighting on both sides had been barbaric.

General Putnik, 67 years old and confined to his room by infirmity, had conducted from maps a brilliant series of operations through his remarkable comprehension of the influence of topography on military campaigns.

Because of their preoccupation with the Russians in Galicia, the Austrians suspended operations against Serbia, but they left a terrible legacy. An epidemic of typhus that had struck their army was inherited by the Serbs in its full virulence. By April 1915, when the scourge was overcome, more than 70,000 Serbian troops and many civilians had died.

**Bulgaria's Entrance into the War.**—The Serbs had not been misled by Bulgarian neutrality during the Austrian invasions. They knew that the Second Balkan War of 1913 had made the Bulgarians their mortal enemies, and that the latter were merely biding their time. In the spring of 1915 the Germans forced the issue. The Allies were at the Dardanelles, and it was imperative that the Baghdad Railway be opened through Serbia and Bulgaria to permit the movement of troops and supplies to Turkey. The German plan was to have Bulgaria enter the war and to crush Serbia with a combined German, Austrian, and Bulgarian invasion. Both sides had made attractive offers of territorial gains to Bulgaria. The offers of the Central Powers, combined with pro-German sentiment, caused Bulgaria to favor them, but from a military point of view she could not declare war while the British-Turkish issue on the Gallipoli Peninsula was in doubt. When it became apparent that the British Dardanelles operation was a failure, however, Bulgaria decided to cast her lot with the Central Powers. On September 6, Germany, Austria-Hungary, and Bulgaria signed a convention agreeing to joint action against Serbia in the following month.

**Collapse of Serbia.**—Alarmed by the Bulgarian mobilization, the Serbs pressed the Allies for permission to attack, but the latter, still hopeful of bringing all the Balkan states into the war on their side, refused. A Serbian attack at that time would have made little difference, however, for the overwhelming forces of the Central Powers arrayed against Serbia presaged her ultimate defeat. Four armies, totaling 300,000 men, were massed on the Serbian border: in the north, the German Eleventh and Austrian Third armies, which were concentrated east and west of Belgrade, respectively; and in the east, the Bulgarian First and Second armies, in position from north to south, respectively. Additional troops were available in the rear areas. German Field Marshal August von Mackensen commanded all except the Bulgarian Second Army; this army, operating under the Bulgarian General Staff, was to isolate the Serbs by cutting the railroad from Salonika.

To meet this onslaught the Serbs had only 200,000 men divided among five armies: the First and Third armies along the northern frontier; and the Timok, Second, and Macedonian armies facing Bulgaria. Outnumbered and threatened from two directions, Serbia had chosen a vulnerable extended linear type of defense. After a heavy bombardment that began on October 6, the German and Austrian armies commenced their passage of the Sava and Danube the next day. Belgrade fell on October 9. The Serbian First and Third armies counterattacked fiercely but unsuccessfully, and to the east the

Bulgarian First Army crossed the border on October 11. By October 18, Mackensen had all of his troops across the rivers and began a full-scale attack. The Serbs on his front were forced back progressively but withdrew in good order to the south and southeast. As they fell back, they blew up stores and depots, and all able-bodied Serbian men left fields and factories to join the retreating armies. To the south the Bulgarian Second Army overcame the opposition of the weak Macedonian Army and, on October 23, captured Veles (now Titov Veles), thus preventing an Anglo-French force of two divisions that was advancing from Salonika from joining the Serbs. These troops, which were all that the Allies could muster to aid Serbia, had arrived too late and in too few numbers to influence the campaign, and by mid-November the Serbs had only the alternatives of surrender or of retreat over the rough mountains. They chose the latter course, and there followed one of the most dramatic and difficult retreats in history. Hard pressed and plagued by hunger and cold, 150,000 men finally reached the Adriatic Sea, whence Allied ships transferred them to Corfu; later they were to join the Allied forces on the Salonikan front. More than 100,000 Serbs had been killed or wounded in the campaign, and 160,000 had been taken prisoner.

The pursuit by the armies of the Central Powers was halted at the Albanian and Greek borders from political rather than from military considerations. Bulgaria wanted to follow the



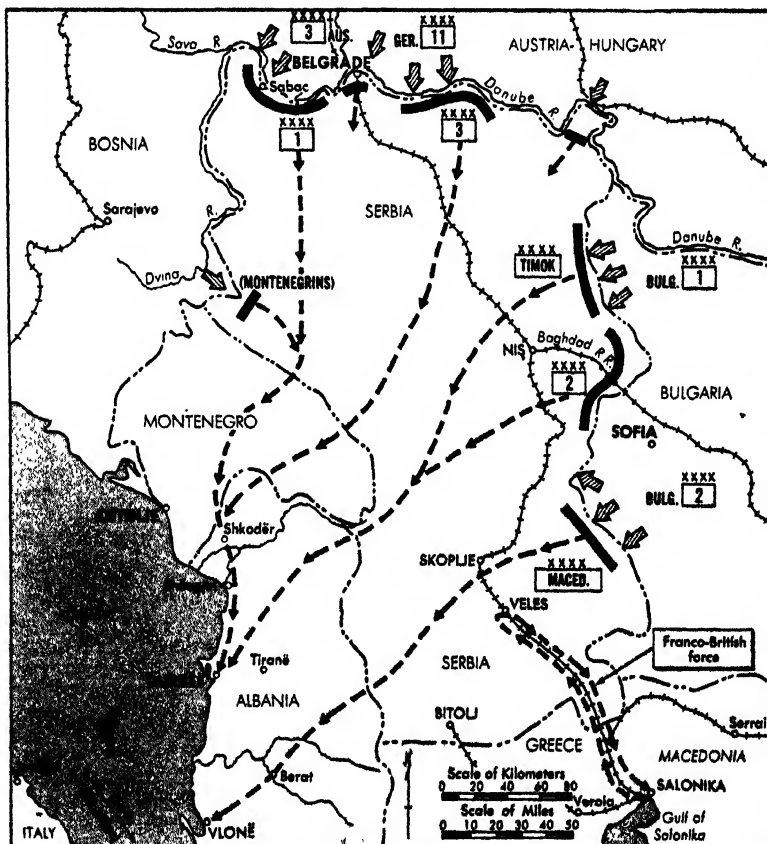
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Peter I watches defeated Serbs retreat (November 1915).

Serbs into Albania, but she was stopped by both Germany and Austria, which did not want her to possess a port on the Adriatic. Similarly, to prevent Austria and Bulgaria from gaining a port on the Aegean Sea, the Germans precluded their advance to Salonika to clear the Allies from Greece.

**Rumanian Intervention.**—Rumania's resources of grain and petroleum placed her in the enviable position of being wooed by two suitors. Allied and German competitive buying increased her wealth, but as time went by, it became more and more difficult for her to remain neutral. Ambitious to expand her territory, she eyed the tempting bait of Bucovina, the Banat of Temes-

**CONQUEST OF SERBIA, 1915.** In October 1915, a combined German-Austrian-Bulgarian offensive was launched against Serbia to open the vital Baghdad Railway. The Serbs, greatly outnumbered and forced to defend themselves on a vast front, were soon overwhelmed. A small Franco-British force advanced from Salonika to help the Serbs, but was turned back by superior Bulgarian forces. In one of the most harrowing retreats in history, 150,000 Serbs finally reached the Adriatic Sea, from where they were transported to the island of Corfu. They were moved to the Salonikan front in 1916, and played a key role in defeating the Bulgarians and regaining their homeland.



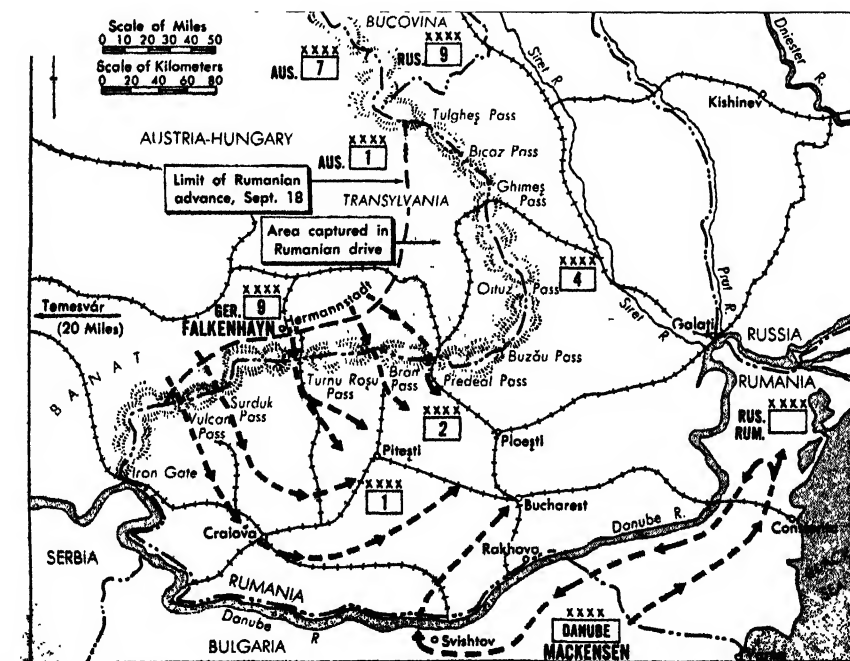
var, Maramures, Crisana, and Transylvania, which the Allies offered for her active participation in the war. Germany was at a disadvantage in bartering, for the areas desired by Rumania belonged to her own allies. In mid-1916 the situation seemed favorable to the Rumanians: Germany was faltering at Verdun, and the Allies were advancing on the Somme; Austria was bogged down in her Italian venture; Gen. Aleksei Brusilov's offensive on the southern Russian front was forcing the Germans back; and the Allied Salonika armies were preparing to invade Bulgaria from Greece. If Rumania now struck south in conjunction with the northward drive of the Salonika forces, the chances of crippling Bulgaria and of cutting the Baghdad Railway to Turkey were excellent. Instead, for two months she bargained with the Allies for further concessions and finally entered the war on Aug. 27, 1916. By then the situation had changed, and the Central Powers had ample troops available to send against Rumania. The latter's political maneuvers had been observed closely by the Germans, who anticipated her entry into the war and had prepared suitable countermeasures. Mackensen, in command on the Bulgarian front, was ordered to organize an army from the available German, Bulgarian, and Turkish forces. The German Ninth and Austrian First armies were directed to concentrate their forces on the Transylvanian frontier, while to the north the Austrian Seventh Army faced the Russian Ninth Army across the border. The concentration of the armies in Transylvania was to be completed by September 30, the earliest date on which it was anticipated that Rumania would declare war.

Despite Allied pressure to join in operations with the Salonika forces to isolate Turkey, the Rumanians decided to realize their dream of regaining Transylvania, a venture that would have little effect on the final outcome of the war. They had mobilized 560,000 men and organized them into four armies and a small reserve. The First,

Second, and Fourth armies were to advance across the mountains into Transylvania, while the Third Army protected the border against Bulgaria. The greatest weakness of the Rumanian Army was its shortage of matériel. There was a dearth of rifles, machine guns, artillery, and signal equipment. Moreover, with neither combat planes nor antiaircraft artillery, Rumania was at the mercy of the Central Powers in the air. Lacking factories to manufacture military supplies and unable to import them from the belligerent countries, she went to war with a scant six-week supply of munitions, relying on her allies' promise of shipments of 300 tons daily through Russia and the Black Sea. Additional Allied aid was promised: energetic Russian action against the Austrians, particularly by the Ninth Army; reinforcement by three Russian divisions on the day war was declared; and an Allied drive northward from Salonika to divert Bulgarian attention.

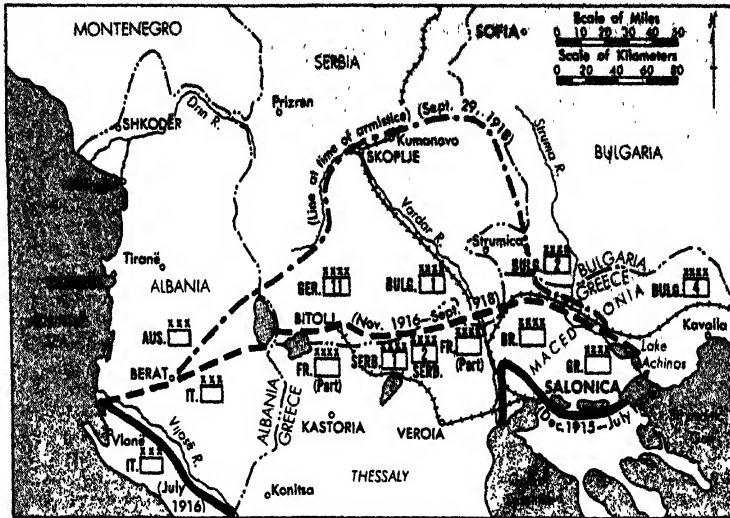
The Rumanian attack toward Transylvania began on August 28. Earlier than had been expected, it caught the German Ninth and Austrian First armies off balance. The Rumanians advanced slowly but steadily, hampered by poor roads and destroyed bridges. The mountains could be crossed only through the passes, some of which were 40 miles apart, so that the armies were divided into many groups scattered over a 200-mile front without lateral communications. Resistance gradually increased, as Gen. Erich von Falkenhayn's German Ninth Army and the Austrian First Army got into position. By mid-September, after an advance that extended about 40 miles in the center, the Rumanian offensive was brought to a virtual standstill.

At this time the situation on the southern front had become critical. Mackensen, who had been ready and had crossed from Bulgaria into Rumania on September 1, had advanced far enough to threaten the capture of Constanța, Rumania's sole port of entry on the Black Sea.



**FALL OF RUMANIA, 1916**  
Rumania entered the war in August 1916, at a time when the Central Powers were not pressed elsewhere and could concentrate their forces against her. The Rumanians advanced to regain their treasured Transylvania—a venture which would have no effect on the outcome of the war—and made some progress. Soon Austro-German resistance stiffened and brought the advance to a halt. Then coordinated offensives by Field-Marshal August von Mackensen's Army of the Danube (Germans, Bulgarians, and Turks) from the south and Gen. Erich von Falkenhayn's German Ninth Army from the northwest overwhelmed the Rumanians and the Russians assisting them, and drove them into northeastern Rumania with a loss of 400,000 men. For all practical purposes, Rumania was eliminated from the war.

**SALONIKAN FRONT, 1915-1918.** The Salonikan front was established in 1915 to help the Serbs, but Allied troops arrived too late and in too little strength to prevent the fall of Serbia. The Allied forces were built up steadily and engaged in limited offensives during 1916 and 1917, without gains of consequence. In September 1918, under energetic leadership and aided by the exhaustion of the Central Powers, a successful offensive was launched which broke the Bulgarians and forced them to seek an armistice. The Serbian Army, transferred from Corfu, played a major role in the successful operations on the Salonikan front.



and the railroad leading inland from it. Three Russian divisions moved south to defend the railroad and the city, while the Rumanian Third Army, three divisions from the Transylvanian front, and a Serbian volunteer division were rushed to the scene. Formed into an army under a Russian commander, these units temporarily stopped Mackensen short of the railroad. On October 20, the German commander, reinforced by two Turkish divisions and with his entire army well equipped, resumed the offensive. Low on ammunition and plagued with supply difficulties, the Russo-Rumanian army was forced back. On October 23, Mackensen captured Constanța and the railroad. Leaving part of his force in a strong position north of the railroad, he moved the rest to Svishtov, where it would be in a position to cooperate with Falkenhayn's drive into Rumania.

Meanwhile, Falkenhayn had pushed the Rumanians back through the mountain passes and was preparing a major offensive. He had no time to lose, for the approaching winter would seriously interfere with the movement of heavy guns and supplies through the mountain passes and would immobilize his army. Therefore, he struck on November 10. The Rumanians fought stubbornly and well, but their leaders were inexperienced, and supplies and munitions were low. (Of the 300 tons of ammunition scheduled to be delivered daily by the Allies, only 30 tons actually arrived.) On November 23, Mackensen launched an attack from the south to join Falkenhayn. Relentlessly, the two German leaders forced the Rumanians back. The latter attempted two attacks across the Danube against Mackensen to prevent his juncture with Falkenhayn. The first, in early October, was disrupted by a sudden flood; the second, in early December, was initially successful and resulted in the capture of 3,000 prisoners, but Falkenhayn sent troops to attack the Rumanian flank and rear, and the Rumanians fell back in panic. By early January, the Rumanian Army, now numbering only 150,000 men, had been driven behind the Siret River in eastern Rumania, where it was saved only by bad roads and torrential rains, which forced the Germans to end their pursuit. Rumania had lost 400,000 fighting men and had

been eliminated as an effective ally. Her vital granaries and oilfields, damaged but not destroyed, were now in the hands of the Central Powers.

**Greece and the Salonikan Front.**—Greece was obligated by a 1913 treaty to come to the aid of Serbia if the latter were attacked by Bulgaria. By the terms of the treaty, Serbia was to provide 150,000 men for the Bulgarian front, but she could not do so because of the German and Austrian concentrations on her northern frontier. Although the Greeks consequently refused to enter the war, Premier Venizelos' suggestion that the Allies provide the 150,000 men was agreed to, and Allied troops began to land at Salonika on Oct. 3, 1915. The Central Powers commenced their advance into Serbia on October 7. The Allied Salonika force under French Gen. Maurice P. E. Sarrail, which was called the Armée d'Orient, started north on October 12. It comprised only 40,000 British and French troops and, as we have seen, was soon cut off from the Serbs by the Bulgarians and pushed back to the Greek border. Had the Bulgarians not been ordered by the Germans to stop at the frontier, they probably would have destroyed the Allied force and its base at Salonika. On the other hand, had the Greek Army of 350,000 men joined the Allies, Serbia might have been saved.

Greek political affairs now troubled Sarrail. Pro-German King Constantine I (his wife was the kaiser's sister) had denounced Venizelos' agreement, forced him to resign on October 5, and repudiated the treaty with Serbia. Sarrail had intended to retain his position on the Greek border, but two Greek corps stood between him and his base at Salonika, and in view of the king's attitude he withdrew to that port. The base was now greatly expanded and strongly fortified, and eventually became known as the "Bird Cage." Allied troops trickled in steadily, and by July 1916 Sarrail had about 250,000 men, including the re-formed Serbian Army, which had arrived from Corfu.

Not only was Sarrail's political situation obscure, but his command relationships were fraught with friction. The various governments persisted in sending instructions directly to





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Captured by Bulgarians in 1915, Bitolj (Monastir) was retaken by Allied troops in 1916; the front remained nearby until 1918. Here Bulgarians attack the town.

their contingents; there were five of these, and Sarraill experienced much difficulty in exercising authority and control. In addition, each arrival or movement of troops was reported by Athens to Berlin, so that the Central Powers were apprised of every detail of the Armée d'Orient. When Rumania entered the war in August 1916, Sarraill moved to protect the Rumanian mobilization by pinning down the Bulgarians. He attacked with his left wing (mostly Serbs) on September 10, while his right wing remained on the defensive. His total force, now called the Armées Alliées en Orient, numbered 350,000. The left wing gained spectacular successes and drove the Bulgarians from Bitolj (Monastir), but the right wing was forced back by the Bulgarians. Bickering between Sarraill and his subordinates and poor support of the Serbs by the other allies had made an important victory impossible.

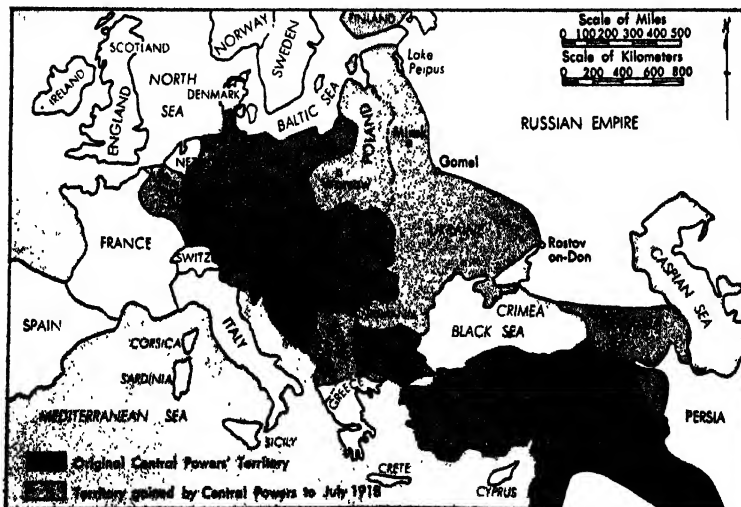
Meanwhile, a smoldering revolutionary movement among the Greeks of Macedonia erupted against their pro-German king and his ministers. The spark was provided by arrangements made by Athens to allow the Bulgarians to take over fortifications at the border from Greek troops. Salonika had a real revolution, and Greek soldiers

and civilians renounced their allegiance and subdued the royalist minority. Venizelos and the commander of the Greek Navy established a revolutionary government in Crete, and as the revolution spread, soldiers and police joined the Allies. The city of Salonika was virtually under Sarraill's control; the Allies took charge of the Greek Fleet, the railroads, and the port of Piraeus; and marines landed in Athens and censored its newspapers.

In May 1917, Sarraill attempted another offensive, but the Serbs, still angry because they had not been properly supported in the 1916 attack and torn by dissension, caused the operation to falter before any appreciable success had been gained. In June, the ineffective negotiations between the Allies and Greece came to a head. Célestin Jonnart arrived in Greece as Allied high commissioner, and French troops landed on the Isthmus of Corinth. Jonnart demanded the abdication of Constantine, who yielded the throne to his second son, Alexander, and sailed on a French vessel for Germany. Venizelos was recalled to power, and on July 2 the new government declared war on Germany and Bulgaria. The addition of the Greek Army permitted the transfer of British divisions needed in Palestine. In December, the incompetent Sarraill was succeeded by an energetic commander, Gen. Marie Louis Adolphe Guillaumat. When Guillaumat was recalled to the western front in July 1918, he was replaced in turn by Gen. Louis Franchet d'Esperey, an excellent soldier.

**Fall of Bulgaria.**—When the German drives of early 1918 on the western front failed and the Allies took the offensive, the Germans bled all their other fronts of men and equipment to bolster their defense. Only the staff and a few small units were left with their Eleventh Army, and the Bulgarians had to supply divisions to fill it out. Since Austria needed all her strength for the Italian front, Bulgaria was virtually alone and ripe for collapse. Franchet d'Esperey had 350,000 combat troops who were well equipped and high in morale. They were opposed by 310,000 men, predominantly Bulgarians, who were short of food, clothing, and munitions and were low in morale.

The Allied High Command decided to launch



**MAXIMUM EXPANSION OF CENTRAL POWERS, JULY 1918.** The Central Powers controlled the greatest expanse of territory in July 1918. The Treaty of Brest-Litovsk had permitted the occupation of vast areas of the Russian Empire. Except for Greece and the southern part of Albania, all of the Balkans were under the Central Powers' control. On the western front the Germans were on the Marne River, and occupied rich northern France and all but the Northwest corner of Belgium. In Italy the Austrians and Germans occupied the rich north-eastern plain down to the Piave River.

in attack in the Balkans in conjunction with their final drive against the Germans on the western front. On Sept. 14, 1918, a heavy bombardment of the Bulgarian lines began, and an initial striking force of six Serbian and two French divisions attacked. A general assault was delivered on September 15 and 16 by British, Serbian, French, Greek, and Italian troops. The offensive was an amazing success from the start. By September 17, the Allies had advanced 20 miles, the Serbs especially distinguishing themselves in furious charges. By September 27, the road to Sofia lay open as the remnants of the Bulgarian armies, split and demoralized, straggled homeward. The Eleventh Army was cut off and forced to surrender.

It was useless for the Germans to urge the Bulgarians to rally. These sturdy peasants were finished with war and were intent on returning home for the harvest. On September 26, Bulgarian emissaries arrived under a flag of truce to request an armistice. Granted on September 29, it provided for demobilization of the Bulgarian Army, evacuation of all occupied territories, surrender of means of transportation, and permission for the Allies to use Bulgarian territory for further operations. No such operations were necessary since both Germany and Austria were in their death throes, and the war ended on November 11.

The Allied Salonika venture remains a controversial subject. Some mark it as a waste of men and resources, while others believe that it had great strategic significance. When its accomplishments are considered, however, the former view appears to be the more logical. The campaign failed to achieve its principal objective—the severance of German-Turkish communications—in time to have any effect on the war, and it did not pin down enough German and Austrian troops to affect adversely their operations in other theaters. Its sole achievement was to defeat the Bulgarians, who in any event would have fallen with the Germans and Austrians a month later. It did protect Greece, but the Greeks themselves were capable of holding their own against the Bulgarians.

For three years, hundreds of thousands of Allied troops suffered in the malaria-infested Salonikan area. British official records list during the campaign 481,262 hospital cases, of which only 18,187 were wounded; French official records in the brief period June–August 1916 show 35,122 hospital cases, of which 672 were wounded.

See also section 15. *Diplomatic History of the War*; separate biographies of the leading figures; BULGARIA—10. *History* (Nationalism); GREECE—7. *Modern History* (Greece in World War I, 1914–1923); MONTENEGRO—*History*; RUMANIA—*History* (World War I: 1914–1918); SERBIA—*History* (World War I).

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### 13. The War at Sea

From the naval point of view, World War I was essentially a struggle between a group of powers which had to obtain their means of waging modern war from within the heart of the European continent and another which were able to obtain these means overseas. For a time, the

second group did include Russia, but that nation collapsed when the maritime powers, Great Britain and France, were unable to overcome geography and reach her with waterborne resources.

Great Britain lies like a breakwater across the sea communications of Germany, whose access to the maritime world is through the North Sea, the Strait of Dover, and the English Channel, waters dominated for centuries by the British Navy. British trade routes, on the other hand, were free from direct German naval threat with the exception of those to Scandinavia. Nevertheless, the geography of the peninsula of Europe enabled Germany to keep the main water routes to Russia closed despite British seapower.

The war at sea in World War I became primarily a contest between the navies of Great Britain and Germany. The former received assistance from the French and United States navies, but the navies of Italy and Austria did little more than counter each other in the Adriatic Sea. The Russian Navy, weak in morale, was locked in the Baltic and Black seas, while the navy of Turkey consisted mostly of two ships of the former German Mediterranean Squadron and their crews. The navy of Great Britain had been its first line of defense for centuries, but the German Navy was a relatively new creation, a product of German nationalism and overseas aspirations. It was essentially a surface navy, designed to challenge the seapower of Britain in the narrow waters of the North Sea. In the end, it contested this power on the oceans with the submarine and came close to winning the war.

Prussia began laying the foundations of German naval power in 1853–1854, when it purchased from Oldenburg a small piece of territory on shallow Jade Bay in the southeastern corner of the North Sea. A port, Wilhelmshaven, was constructed there at great expense and completed in 1869. By annexing Holstein in 1864 after the war with Denmark, Prussia also obtained the excellent port of Kiel. A canal between Kiel and the Elbe River estuary connecting the Baltic and North seas was completed in 1895. By 1914 this canal had been deepened and widened so that the largest ships of the German Navy could transit it.

The growth of the German Navy was stimulated by trade competition with Great Britain and by a growing antagonism toward that strong maritime power. Bills for increased naval construction were enacted in 1898, 1900, and 1905, the last calling for a fleet built around 40 battleships to be completed by 1917. A navy that could challenge Great Britain was thus created over opposition of the Imperial General Staff and of liberal elements in the Reichstag. It was primarily the work of Adm. Alfred von Tirpitz, who was the first trained seaman to serve as secretary of state for naval affairs, and who had the support of Emperor William II.

This expansion of the German Navy could not help but affect Great Britain. While the modern British Fleet had been building since 1889 as an answer to the current naval ambitions of France and Russia, these two countries no longer presented a threat to Britain after 1904. Instead, the rising German Navy forced the British into an alliance with them. The development of the Triple Entente (q.v.) permitted the area of activity of the British Fleet to be transferred from the Mediterranean Sea and the English Channel to the North Sea, and a major naval

shipbuilding program was inaugurated to maintain a 60 percent superiority over the Germans. The armament and speed of warships were improved, and oil was adopted as fuel. This progress culminated in the design of the five powerful battleships of the *Queen Elizabeth* class, which were armed with 15-inch guns and could make 27 knots.

In both Britain and Germany the capital ship monopolized naval planning to the exclusion of more modern types, such as the destroyer, the submarine, and the airplane. The British Navy stressed speed and the largest possible caliber of guns in order to retain initiative and the offensive, while the Germans emphasized hitting power and strong construction at the expense of speed and radius of action, which they considered secondary for a navy built primarily for attrition operations in the North Sea.

The skill of their naval designers and the competence of their officer corps made the German Navy, ship for ship, a formidable rival to that of Great Britain. In many technical features of gunnery and damage control, the Germans were superior. War planning in both countries, however, left much to be desired. Navies had gone through a long period of technological changes but had experienced little combat to test the strategic and tactical effects of these changes.

In Germany, Admiral von Tirpitz, in his efforts to keep the navy independent, had allowed the General Staff to ignore his service in their war plans. No provisions were made for such joint operations as seizing the Continental side of the English Channel or stopping the flow of troops and supplies from England to France. At the same time, the German Navy, in its concentration on the capital ship, failed to develop the full potentiality of the torpedo, the mine, and the submarine, obvious weapons of a lesser naval power.

In Great Britain the two services also made their war plans separately. The admirals expected to conduct a close blockade of Germany and to employ ground forces in amphibious operations on the German coast, ignoring the development of steam navies and high-powered ordnance, which would make such plans difficult to carry out. They also ignored the fact that British military leaders were thinking about something entirely different. The latter, despite their country's control of the seas, were worried about invasion, and they made plans for employing their forces offensively, not in exploiting the mobility and freedom of action of seapower but rather in reinforcing the French Army on the Continent. This revolutionary change in British strategy stemmed from staff conversations with the French that began in 1906. Although these conversations never reached the form of agreements or plans, they committed the small British regular army of seven divisions to employment in France in the event of war with Germany. When war finally came, these seven divisions were followed by millions of men.

**Early Actions.**—The opening of the war found Winston Churchill as first lord and Prince Louis of Battenberg as first sea lord, the highest civilian and naval positions in the Admiralty. Adm. Sir John Jellicoe (later 1st Earl Jellicoe) had command of the British Grand Fleet. This fleet was at its war base in Scapa Flow in the Orkney Islands, while the German High Seas Fleet cut short its cruise to Norway to return to the Jade.

Since both fleets were built around battleships and battle cruisers, it is necessary only to compare figures in these types to get an idea of comparative naval strengths. The Grand Fleet had 19 dreadnoughts, 8 predreadnoughts, and 4 battle cruisers, while the High Seas Fleet had 13 dreadnoughts, 8 predreadnoughts, and 4 battle cruisers. In the Mediterranean the British had 3 battle cruisers, and the Germans 1. A total of 8 cruisers and 96 torpedo craft guarded British coastal areas, especially the Strait of Dover. The British had 24 new and 31 old submarines, while the Germans had 10 new and 18 old ones.

The first naval operation of the war, which took place in the Mediterranean, was a decided victory for the Germans. This was the escape of the battle cruiser *Goeben* and the light cruiser *Breslau* to Constantinople. Vice Adm. Wilhelm A. T. Souchon boldly took action on his own initiative while the British commanders were receiving conflicting instructions from the Admiralty. The two ships were added to the Turkish Navy, a step which had a decided effect in bringing Turkey into the war on the German side.

The British took the initiative in the first surface action in the North Sea. On Aug. 28, 1914, a sweep by five battle cruisers toward Helgoland resulted in a light-force action that cost the Germans three cruisers. This action set the pattern of ambush and hit-and-run raids that characterized North Sea fighting throughout the war.

A few weeks later, on September 22, the German submarine *U-9* sank three British cruisers, the *Cressy*, *Hogue*, and *Aboukir*, off the coast of the Netherlands. This action made a deep impression on both naval commands. It caused the withdrawal of the Grand Fleet to the north of Ireland, while bomb and net defenses were installed at Scapa Flow. The fleet was therefore 300 miles away from the North Sea when the German Army captured Antwerp and almost took the Channel ports. This series of setbacks, combined with a lack of the action that the British public had expected from its fleet, caused the resignation of Prince Louis of Battenberg and the reappointment of the 1st Baron Fisher, who had been first sea lord from 1904 to 1910. On Nov. 2, 1914, the North Sea was declared a war zone and mined, and neutral shipping was instructed to proceed by certain channels or accept the risk involved. This step gave the Germans a precedent for justifying the war zone which they declared around Great Britain in February 1915 in their all-out submarine campaigns.

A major task of the British Fleet, second only to the security of the British Isles themselves, was the protection of overseas trade and of troop movements against the German cruisers that were on foreign stations when the war commenced. The *Emden*, which had been detached from the German Far East Squadron to raid in the Indian Ocean, sank 15 ships before she was finally run ashore by the Australian cruiser *Sydney*, and the *Karlsruhe* in the West Indies destroyed 17 ships before she was destroyed by an internal explosion. Meanwhile, other raiding cruisers destroyed a few more British ships.

The German Far East Squadron, under Vice Adm. Maximilian von Spee, posed the principal threat to British shipping and convoys in the Indian and Pacific oceans. This squadron, consisting of the armored cruisers *Scharnhorst*

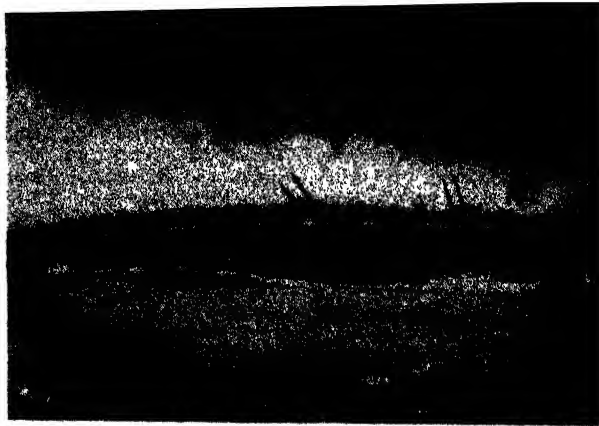
and *Gneisenau* and the light cruiser *Nürnberg*, crossed the Pacific and was joined by two more light cruisers, the *Leipzig* and *Dresden*. Off Coronel, Chile, on Nov. 1, 1914, it met an inferior British squadron, consisting of the armored cruisers *Good Hope* and *Monmouth*, the light cruiser *Glasgow*, and the auxiliary cruiser *Otranto*, under Rear Adm. Sir Christopher Cradock. The Germans sank the two armored cruisers in a short action, and the other British ships made their escape.

This disaster brought a quick reaction from Lord Fisher. The battle cruisers *Invincible* and *Indefatigable* were sent to the South Atlantic, where they were joined by four other cruisers. In the meantime, the German squadron had entered this area on its way home. The British ships were coaling at the Falkland Islands on December 8, when Admiral von Spee, unaware of their presence, decided to raid the British station. The result was that the Germans were caught in a running fight with a superior force. Only the *Dresden* escaped, and she was found and destroyed three months later off the Juan Fernandez Islands.

By December 1914, therefore, the German surface raider threat was ended. Conditions had changed since the days of the *Alabama* in the American Civil War. Dependence on coal plagued the German cruisers, and radio telegraphy made it relatively easy to track them. The submarine would be the commerce raider of the future.

In the North Sea the German battle cruisers had made a sweep in November 1914, and on December 16, they bombarded Scarborough, Hartlepool, and Whitby on the English coast. These operations were undertaken for the purpose of drawing out and engaging detached British forces. On Jan. 24, 1915, these ships made a sweep to Dogger Bank, two thirds of the way across the North Sea, hoping to catch British light forces patrolling in the area. A short time before, however, the British had obtained a code book which had been jettisoned from a German cruiser grounded in the Baltic and recovered by a Russian diver. Since the Germans never radically changed their codes, the British thereafter were able to secure advance information on their operations.

Rear Adm. David Beatty with five battle cruisers, the *Lion*, *Tiger*, *Princess Royal*, *New Zealand*, and *Indomitable*, and a light cruiser squadron, thus could leave the base at Rosyth in the Firth of Forth just a few minutes after Rear Adm. Franz von Hipper, with three battle cruisers, the *Derfflinger*, *Moltke*, and *Seydlitz*, and the armored cruiser *Blücher*, cleared the Jade. When the Germans reached a point about 30 miles north of Dogger Bank and 180 miles west of Helgoland at 7 A.M., they found the British waiting for them. Hipper immediately reversed course and sped for his base with the British in pursuit. Shortly before 9 A.M., the British ships began to come within range and opened fire on the *Blücher*, the last ship in the German column. Fire was later shifted to other German ships, and the *Seydlitz* was seriously damaged. The Germans concentrated on the *Lion*, the leading British ship, which was struck several times, causing her to fall out of line. Poor fire distribution and faulty communications on the part of the British allowed the three battle cruisers to escape. The *Blücher* was sunk,



The Bettmann Archive

German armored cruiser *Blücher* sinks after battle near Dogger Bank, Jan. 24, 1915. Some of crew are rescued.

but not before a British photographer obtained one of the best naval photographs of the war. The Germans profited from this defeat, for they strengthened the side plating and turret tops of their battle cruisers and improved the protection of the magazines and ammunition supply. These changes were to pay large dividends a year and a half later at Jutland.

**Dardanelles Campaign.**—By 1915 the war on the western front had stabilized into one of grinding attrition that was to absorb millions of men and such vast quantities of ammunition that the economies of all countries almost collapsed under the strain. Since Britain was then the only Allied power that held the initiative, some British leaders looked for means of outflanking the German position and establishing communications with Russia. Lord Fisher wanted a combined naval and military attack in the Baltic and started a building program for such a great amphibious undertaking. This plan, however, was not considered seriously by anyone else. It could succeed only at enormous cost, for the Germans feared such an attack and would have resisted it furiously.

An alternative was opening the Dardanelles. Churchill, who at first espoused the Baltic plan, now shifted his interest to what appeared to be a less costly project. French military leaders and some British opposed the operation, which they feared would withdraw or withhold troops from France. The 1st Earl Kitchener, who was the secretary of state for war, wanted to strengthen Russia but refused at this time to make any troops available. Churchill accordingly agreed to a primarily naval attack.

Fisher would agree to the Dardanelles operation only if certain conditions, including the use of troops, were fulfilled. Churchill solved his dilemma by going over Fisher's head to the naval commander in the area, Vice Adm. Sackville H. Carden, who provided a plan that combined reduction of the Dardanelles forts by naval gunfire with minesweeping. Obsolete French and British battleships, whose loss would not affect the seapower balance, were to be used. The new battleship *Queen Elizabeth* was added, and an enthusiastic Churchill could see the Dardanelles forts falling successively before her 15-inch guns.

Carden's plan had made no provision for dealing with mobile artillery, and Churchill assumed that the British intelligence reports were

correct. These, however, gave information only on the forts and none on the action of Gen. Otto Liman von Sanders, head of the German military mission to Turkey. Liman von Sanders realized that, in addition to the forts, the mine fields would have to be covered by mobile artillery. He bypassed Constantinople in the movement of this artillery and, by keeping its movement secret even from the German commander of the Dardanelles defenses, prevented British intelligence from learning of its existence.

After the combined naval attack was agreed on, British leaders hurried the project and failed to make proper preparations, especially for minesweeping. The first attack of the Franco-British squadrons on the outer forts was made on Feb. 19, 1915, and a second attack followed on February 25. The outer forts were reduced, but after the initial bombardments it became evident to Carden that amphibious troops were needed. Churchill ignored his requests, insisting that he go on with the original plan. Operations were renewed on March 4, and were continued for two weeks, with the big ships bombing by day and the minesweepers attempting to sweep at night. The latter could make little progress against the current, however, and suffered heavily from the field guns.

Carden's health finally broke down, and he was relieved by Rear Adm. Sir John de Robeck, who decided on an all-out daylight bombardment with minesweeping operations under its cover. This attack was made on March 18. Things went well until early afternoon. The forts appeared to have been silenced, but when the minesweepers proceeded to their work, the field guns drove them back with heavy losses. A French battleship, *Bouvet*, had already been sunk by an unswept mine. De Robeck recalled his heavy ships, and in the retirement another battleship and a battle cruiser were destroyed by mines, while a second cruiser was damaged. Two other ships were put out of action by gunfire. De Robeck ordered a general withdrawal.

The whole problem was then reappraised, and a purely naval attack was abandoned. The campaign against Constantinople was to go on, however, with the army now given the main task and the navy assisting it. An army force under Gen. Sir Ian Hamilton, consisting of a regular division from England, the Australian and New Zealand troops, a naval infantry division, and a few French, had been assembled in Egypt. This force was not prepared for assault amphibious operations, however, and a month was lost in re-loading. Liman von Sanders thus had the time he needed to get ready for the attack, which was made on the Gallipoli Peninsula on April 25, 1916. The whole campaign eventually failed, the Allies suffering their most costly setback of the war. The result was a shakeup in the British cabinet that included the removal of Churchill.

See also section 11. *Turkish Campaigns.*

**Battle of Jutland.**—The next major naval action, the Battle of Jutland (or Skagerrak, as it was called by the Germans), took place on May 31–June 1, 1916. The war had been in progress for almost two years before this main fleet action toward which the building and training of navies had been directed for a generation finally took place. The two fleets had been acting on the defensive, but events in early 1916 brought a change in their attitude. Russia, blockaded by Germany, was suffering more than Germany,

blockaded by Britain. To break this blockade the Allies would have to gain control of the Baltic, and before this could be done the High Seas Fleet had to be destroyed. The Grand Fleet now had suitable bases along the east coast of Britain closer to Germany and was in a better position to press for the necessary decisive action. On the German side command of the High Seas Fleet had been taken over by a new man, Reinhard Scheer, a choice of Tirpitz and an advocate of offensive action. Scheer planned a series of raids in which all forces, including submarines and zeppelin airships, would be used. The purpose of these raids was to draw out detachments of the British fleets, which would be attacked by submarines and surface forces.

The first German raid was made by a force of battle cruisers, which on April 25, 1916, bombarded Lowestoft and Yarmouth. Scheer next planned a bombardment of Sunderland, but bad weather caused him to make instead a sweep to the north to raid Allied shipping off Scandinavia and possibly attack the British blockading force, the 10th Cruiser Squadron. If necessary, he could withdraw via the Skagerrak.

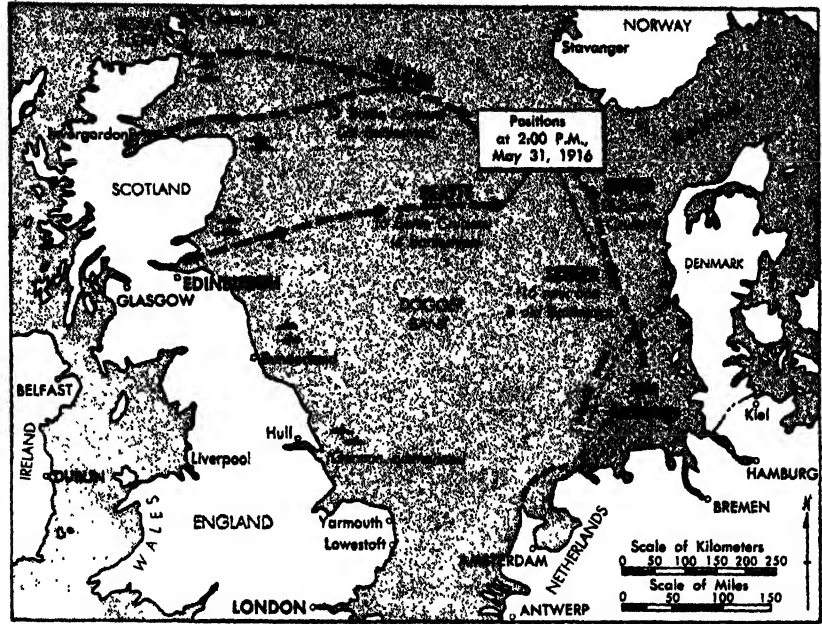
The High Seas Fleet, with 16 modern and 8 old battleships under Scheer and 5 battle cruisers under Hipper, sortied from the Jade for this operation in the early hours of May 31, and headed north with Hipper about 50 miles ahead of Scheer. Since the British were still reading coded German radio dispatches, the Grand Fleet got to sea even before the Germans. The main body under Jellicoe, which consisted of 24 dreadnoughts and 3 battle cruisers with attached light forces, left Scapa Flow and Invergordon at about 10 P.M. on May 30. At the same time, the scouting force under Admiral Beatty, consisting of 6 battle cruisers and 4 modern battleships of the *Queen Elizabeth* class, left Rosyth. Both groups proceeded eastward separately. At 2 P.M. on May 31, Beatty was to be 70 miles south of Jellicoe, and if at this time he had not sighted the Germans, he was to turn north and join the commander in chief. Neither Jellicoe nor Scheer knew that the main body of the other's fleet was at sea, for Scheer had taken the precaution of having the radio guard ship in port acknowledge all messages addressed to him.

Shortly before Beatty was to turn north, one of his cruisers sighted smoke to the east, which was found to come from a Danish freighter that had been stopped by two German destroyers. This contact brought on the battle, for at 2:20 P.M. Beatty turned southeast and increased speed, hoping to get between the enemy and his base. Meanwhile, Hipper, on learning of the contact, turned to a northwesterly course to develop it. The light forces screening Beatty and Hipper had by this time been drawn off to the north, so that at 3:25 P.M. the battle cruiser squadrons sighted each other without previous warning. Beatty's 4 battleships were several miles astern of him.

To prevent the British from getting between him and Scheer, Hipper reversed course. With both forces on parallel courses, fire was then opened at about 17,000 yards and continued for an hour. The German fire was more effective, sinking the battle cruiser *Indefatigable* at 4:06 P.M. and the *Queen Mary* at 4:26 P.M. Beatty's flagship, the *Lion*, lost a turret, as did the German *Seydlitz*. Other ships on both sides also received hits. The Germans at this time were



**BATTLE OF JUTLAND, 1916:**  
**OPENING PHASE.** The German High Seas Fleet sortied from its base in the Jade Bay anchorage to raid Allied shipping off Norway and attack the British blockading force. The British, by decoding German radio messages learned of this move, and their Grand Fleet put to sea to intercept it. By 2 P.M. on May 31, the two fleets were in the positions shown. At this time, neither Adm. Sir John Jellicoe nor Adm. Reinhard Scheer knew that he was confronting his opponent's main fleet.



leading the British battle cruisers toward the main body. The German battleships were sighted at 4:33 P.M. by the 2d Light Cruiser Squadron under Commodore William E. Goodenough, who in Beatty's van was alone properly performing the duties of a light force. Beatty held his course until 4:40 P.M., when, with the High Seas Fleet in sight, he turned north to come close to Jellicoe. His 4 heavy battleships, which by this time had taken the German battle cruisers under fire, continued on a southerly course until 4:57 P.M., passing Beatty and covering his rear. The pursuit north lasted until 6 P.M., during which time Goodenough, under fire of the German battleships, nevertheless maintained contact and sent accurate reports.

The battleship squadrons of the Grand Fleet in the meantime were approaching on a southeasterly course, while the battle cruisers, under Rear Admiral Sir Horace Hood, were considerably to the east. The choice of deployment of the battleships from a cruising formation of line of divisions into a long line ahead had to be made on either the right-hand or the left-hand division. Since this decision depended on the location of the German battlelines, Jellicoe delayed his deployment signal until 6:14 P.M., when he finally obtained the correct position of the German main body from Beatty. He deployed his squadrons to the left and took an easterly course to get between the German Fleet and the coast. This maneuver took about 20 minutes, during which time Beatty's cruisers crossed the line of deploying battleships and took up stations in their van. Hood took position ahead of Beatty, while Beatty's 4 battleships took position in the rear of the battleship squadrons of the Grand Fleet.

The German main body, led by Hipper, was then on a northeasterly course. Hood's battle cruisers first came into contact with the Germans and took them under a heavy fire, which put the Lützow, Hipper's flagship, out of action at 6:33 P.M. Hood's flagship, the *Invincible*, was herself sunk by fire from the German battle cruisers

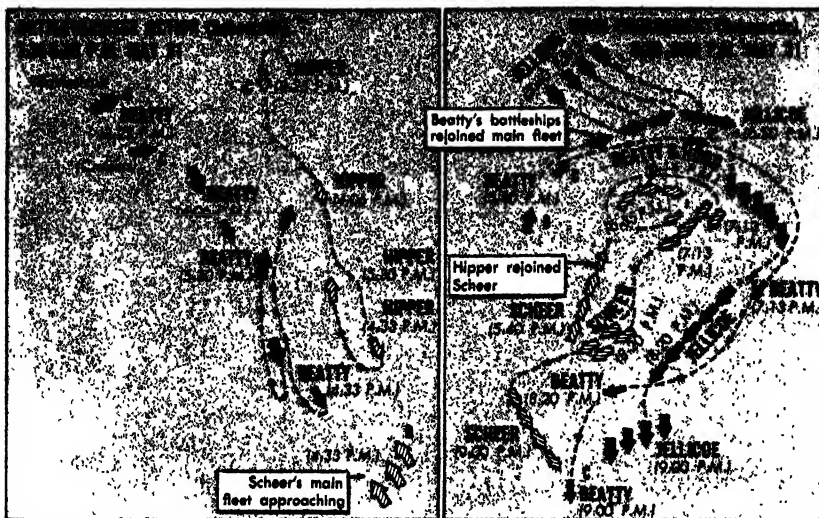
and the leading battleships.

The battleships on both sides were now beginning to engage with the Germans in a bad position, the whole British fleet crossing their van. By 6:26 P.M. the German battle cruisers in the lead were forced to turn away to prevent being caught in a trap. At 6:35 P.M., Scheer ordered his famous *Gefechtskehrtwendung* (emergency retirement by ripple movement from the rear), a maneuver which his ships had often practiced, and which was successfully accomplished despite an elbow in the line.

In the poor visibility, Jellicoe did not see this turnaway and lost contact with the enemy. Keeping to his purpose of getting between the Germans and their base, however, he changed from an easterly to a southeasterly course. Scheer, having successfully extricated himself, for some unknown reason once more reversed course and returned to the battle on an easterly heading, almost at right angles to the British battleline, which in the meantime had changed to the south.

The German Fleet was no sooner turned on an easterly course again than it was reported at 7:00 P.M. by the ever-watchful Goodenough. A few minutes later, at 7:05 P.M., the British battle cruisers commenced firing, and some of the battleships shortly followed suit. The range was down to 7,500 yards, and visibility conditions were now most favorable to the British. At 7:13 P.M., Scheer again extricated his battleships from a bad position by an emergency retirement behind the continued engagement of his battered battle cruisers and a destroyer torpedo attack. The torpedo attack was successful, for at 7:21 P.M. Jellicoe ordered a turnaway of 45° from south to southeast. The British battleship divisions remained on this course for 14 minutes, until the German torpedoes passed their line, whereupon Jellicoe again returned to a southwesterly course. The turnaway maneuver lost Jellicoe his chance to destroy the German Fleet.

After breaking contact, the Germans changed to a southerly course. From 8 to 9 P.M., the



**BATTLE OF JUTLAND, 1916: FINAL PHASE.** The first action was between the scouting forces of Rear Adm. David Beatty and Rear Adm. Franz von Hipper. Hipper sought to lure Beatty, south to the main German force under Scheer. Beatty spotted Scheer in time and reversed his course, attempting in turn to lure Scheer to Jellicoe's battleships. The two main fleets met about 6 P.M. and engaged each other until dark; Jellicoe, meanwhile, succeeded in getting between Scheer and his base. During darkness the Germans broke through the British formation and escaped to the Jade anchorage. Both sides suffered serious but not crippling losses. The German High Seas Fleet made no major sorties thereafter.

British were generally on southwesterly courses, and the battle cruisers in the van again made contact and scored some hits before the Germans turned away to the west. In the closing daylight, Jellicoe now decided not to endeavor to regain contact, and at 9 P.M., realizing that he was between the Germans and their bases and in a favorable position for action the following morning, he put the fleet on a night course of south. A light cruiser squadron was placed in the van, while destroyers covered the rear. At 9:30 P.M., the British battleship squadrons were approximately 10 miles east of the German High Seas Fleet, while the British battle cruisers were approximately 5 miles ahead of it.

Scheer, who knew only that the British were east of him, was determined to break through and return to his base. Putting his heaviest ships in the van, he set his course to the southeast with orders to hold it regardless of cost. The result was a series of confused but deadly night encounters from 10 P.M. to 2 A.M., as the Germans forced their way through the British light forces, leaving a trail of burning vessels to mark their course as surely as the compass in Scheer's flagship. Two British battleships saw this night action but did not report it, and Jellicoe himself failed to realize the significance of the gunfire astern. It was not until 5:40 A.M. that he knew the German Fleet had evaded him. Scheer anchored in the Jade about noon on June 1, and with all chance of further action gone the Grand Fleet headed back for its bases.

The Battle of Jutland, involving over 250 ships, was and probably will remain the greatest battle in naval history. It was also one of the most indecisive and subsequently the most studied. Records were kept in every ship, even in the height of action, of almost every happening pertaining to navigation, ordnance, propelling machinery, and casualties. Approximately 10,000 messages were sent during the battle, and 300 action reports were prepared after it. Sufficient data was available to locate 65 percent of the major-caliber hits. The wealth of material resulted in the battle's receiving an emphasis in naval circles far greater than it deserved. The myth of the battleline engagement was preserved for another 25 years, after the airplane and the

submarine had changed the whole nature of naval warfare. The indecisive result should have revealed that technological advances had out-distanced the commander's means of controlling his forces, and that the tactical doctrine of steam navies had not yet reached full development.

Both sides showed inability to use light forces properly for reconnaissance and security. The Germans were superior in gunnery and ship handling. By holding to the principle of the offensive, Scheer extricated his fleet from some dangerous situations. Jellicoe, obsessed with the safety of his battleships, missed his one chance to obtain a decisive action. The result was that the German Fleet remained to be a bulwark for its submarines. The British were forced to keep a mass of light craft locked up with the Grand Fleet when they were urgently needed for the struggle against the submarine. Far more important perhaps, the High Seas Fleet, by still barring the Baltic, hastened the destruction of Russia and the consequent rise of communism.

See also JUTLAND, BATTLE OF.

**Allied Blockade of Germany.**—After Jutland surface action almost ceased, and the war at sea became a war against trade that was as much a form of economic as of naval warfare. A history of World War I must therefore include not only the struggles on land and at sea but also the warfare against trade, primarily the overseas trade that was so important in the economic life and war potential of both Great Britain and Germany. This war against seaborne trade can be divided into (1) the blockade of Germany by the Allies, including the regulation of trade with neutrals bordering on that country; and (2) the German submarine campaign and the Allied defense against it. The Allied blockade of Germany falls into two distinct periods. The first spans the two and one half years during which the United States was a neutral. During this time international law still had some force, but when the United States became a belligerent on the Allied side, legal aspects were set aside. In the Allied view, this course was justified by the unrestricted submarine warfare of Germany.

The oceans of the world have been described by the naval philosopher Alfred Thayer Mahan as a great common, used in war by both bellig-

rents and neutrals. Because of this, there has grown up a body of custom, generally called international law, for the conduct of sea trade in wartime. This law gives a belligerent the right to capture an enemy's merchant vessels, to stop them into and from enemy ports, and to confiscate goods found at sea which are to be used by the enemy for war purposes. To accomplish these objects, a belligerent war vessel has the right of visit and search—that is, the right to stop all vessels to determine their nationality and to learn whether or not they are breaking a blockade or carrying contraband. Private goods at sea are not subject to outright confiscation, however, but must be condemned in an admiralty court, generally known as a prize court.

In the 19th and early 20th centuries efforts were made to codify this international law by agreements between the maritime nations. The Declaration of Paris (q.v.) in 1856 abolished privateering, declared that a blockade to be binding must be effective, and gave protection to all neutral goods except contraband. The Declaration of London (q.v.) in 1909 attempted to define and specify contraband. Absolute contraband was to comprise military goods and conditional contraband goods that could be put to war purposes, while free goods, including such items as raw cotton, fertilizers, and metallic ores, could not be declared contraband.

Neither the Declaration of Paris nor that of London took into account the changes taking place in modern war. Naval weapons such as the submarine, the torpedo, and the mine had made the old type of close blockade as well as visit and search at sea impossible. Under the modern concept of total war, all commodities were considered to have military value. Finally, Germany had on her land borders several Continental neutrals whose trade with her a naval force could not interdict.

New methods therefore had to be adopted by the major maritime power, Great Britain, to cut off the seaborne trade of the Central Powers, especially Germany, and to prevent the means of war in the form of goods from reaching these countries from overseas. This was finally done by a system of trade controls that was to give new meaning to the term "blockade." In this new form, economic pressure was brought to bear not so much by naval ships directly as by a system of trade restrictions which control of the sea made possible. In 1915 and 1916 these restrictions or blockade in its new form gradually evolved within the five following categories:

(1) Inspections in port replaced the visit and search of former days. The dangers of modern weapons and the size and variety of cargoes carried made the old method of inspection at sea impossible. Instead, British cruisers directed suspected neutral vessels into ports for examination. These ports were the Downs, for trade through the English Channel; and Kirkwall in the Orkney Islands, for the northern route, where a cruiser squadron was stationed to enforce the new system.

(2) Rationing was a method by which the Continental neutrals bordering on Germany were allowed supplies sufficient only for their own use. Based on an elaborate statistical system, it was given legal sanction after a British prize court condemned the steamer *Kim* for carrying an amount of lard to Denmark far in excess of

that country's normal imports.

(3) Written clearances in the form of letters of assurance or navicerts were given to neutral ships sailing to Europe from the United States or other neutral nations. A navicert certified the contents of the cargo, thereby speeding a ship's examination. Most neutral shipping companies except those of Sweden, which were forbidden to do so by their government, cooperated with the Allies in both rationing and inspection and accepted navicerts. Sweden was still linked economically to Germany, and the Allies could not forget that it lay athwart their own lines of communication to Russia.

(4) Blacklists were publications of names of firms that were known, either through Allied intelligence or by postal and telegraphic censorship, to be trading with the Central Powers. Neutral ships were forbidden to transport their goods.

(5) Bunker control, or the issue of British coal to neutral vessels, was the club which made the other controls possible. Great Britain not only supplied coal to European countries for industrial and commercial use, but also controlled most coaling stations. (At this time, American coal offered little competition to the British product.)

By the beginning of 1916 the blockade in its new form was becoming effective. What had begun as an excellent code without machinery had become under the Ministry of Blockade an excellent machinery without a code. Shortages of fibers, oils, fats, lubricants, and fertilizers began to be felt in the Central Powers. Combined with the crop failure of 1916, they caused considerable suffering among the civilian populations, although the armed forces of these nations never experienced shortages in armaments or supplies.

When the United States entered the war in April 1917, it placed restrictions on trade that the Allies would never have attempted while it was still a neutral. Controls could now be effected at the source, and most of the machinery of the blockade could be abandoned. By the autumn of 1917 the Central Powers were deprived of all foreign supplies.

Like the blockade of the Confederacy in the American Civil War, the contribution of the Allied blockade of Germany to the final victory is difficult to assess. Victory certainly could never have been secured solely by economic encirclement, but when the armies of the Central Powers began to be defeated, the collapse came with the crumbling of civilian morale brought on by deprivations. In expanding her industrial economy before the war, Germany had come to depend too heavily on overseas trade for food and raw materials. The lesson of World War I was that she must draw these necessities from the Eurasian continent.

The blockade of Germany was essentially a form of economic warfare, but it was based on control that the British Navy had maintained for a century and more. Where the arms of British seapower could not reach, however, economic warfare broke down, as it did with Sweden in the Baltic and Rumania on the Black Sea.

See also *BLOCKADE—Practice in World Wars I and II*; *CONTRABAND*; *PRIZE COURTS* and *PRIZE JURISDICTION*.

**German Submarine Campaign.**—Germany's answer to the Allied blockade was its submarine campaign against merchant shipping. In

order to view this submarine warfare properly as a form of blockade of Great Britain, certain facts must be kept in mind:

(1) Four fifths of Britain's food, all of her raw materials except coal, and half of her iron had to be imported.

(2) British war plans had assumed that the Grand Fleet, by containing the High Seas Fleet, would maintain control of the seas and thus preserve the overseas lifeline. The Allies could therefore proceed with the blockade of Germany without fear of retaliation.

(3) Command of the sea enabled the Allies to draw on the resources of the United States and deny these resources to Germany. The United States therefore became the major and even the predominating force in the struggle.

(4) Despite the size and efficiency of the High Seas Fleet, the Germans were unable to change the prewar naval situation by surface forces alone.

(5) The submarine was singularly fitted for attacking the large concentrations of shipping in the approaches to the British Isles.

The success of the *U-9* in sinking three cruisers in a matter of minutes in September 1914 opened the eyes of German naval officers to the potentiality of the submarine, and as early as November of that year German naval authorities recommended its use against British sea trade. The German political point of view, however, was that, while there were no legal obstacles to a U-boat campaign, a decision to embark on this new type of warfare would be made only when the military position on the Continent was so secure that there could be no doubt of the eventual outcome.

By February 1915, the campaign on the western front had been stalemated, and it was apparent that the war was not to be the short one that the General Staff had planned. In November 1914, Great Britain had declared the sea approaches to Germany a war zone forbidden to merchantmen. In addition, the list of con-

traband had been extended to include even grain. The Germans knew that such economic pressure would increase, with their country becoming a fortress beset, and it was this knowledge that led them to decide to use submarine in the war against Allied seaborne trade. On Feb. 4, 1915, the waters around the British Isles were declared a war zone where (effective February 18) submarines would destroy enemy ships and neutral merchantmen would travel at their own risk.

The submarine was unable to comply with the rules of international law adopted for a war against trade by cruisers, for it could ensure its own safety only by sinking ships without warning. The German leaders failed to take into account the reaction of world opinion, especially opinion in the United States, to the changes in the rules of warfare which they were unilaterally adopting to suit the new weapon. They tried to justify their stand on the ground that Great Britain had been the first to violate international law, but they failed to recognize that British policy offered neutrals an alternative while their own presented only an ultimatum: cease trade with the Allies or risk destruction of life and property.

The one nation strong enough to dispute the new German attitude toward international law had only a small merchant marine, but American public opinion was shocked at the loss of life that this new warfare would evidently cause and the United States government refused to compromise on the rights of its citizens to travel under the protection of international law.

After the sinking of the *Lusitania* (q.v.) on May 7, 1915, with the loss of 128 American lives, three notes were required to convince the German government that it had to take cognizance of American public opinion. The first indication of a tendency to yield appeared when Berlin made apologies and offers of reparations for the destruction of two United States freighters, which the Germans claimed had been sunk by mistake. On August 19, the British liner *Arabic* was sunk under conditions similar to those of the *Lusitania*, but before any action could be taken by the United States Germany requested President Woodrow Wilson to await official investigation. On September 1, the German government submitted the information that the *Arabic* had been destroyed in error after the German commander had been instructed not to sink liners without warning and without providing for the safety of the passengers. On March 24, 1916, however, the British channel steamer *Sussex* was torpedoed with the loss of several American lives. After a brief correspondence, on April 18, the United States government demanded assurances that ships would no longer be sunk without warning and without regard for the safety of persons on board, and threatened to sever diplomatic relations if such assurances were not given. Faced with an ultimatum, the German government yielded, but in its reply of May 4 included a statement that it expected the United States to induce Great Britain also to observe the rules of international law. The United States refused to admit that the rights of its citizens could be held conditionally, and there the matter rested until January 1917.

Behind these events lay a controversy within the German government. The naval administration headed by Admiral von Tirpitz held that the

Passengers and crew leave sinking French steamship *Sontay*, torpedoed in the Mediterranean on April 16, 1917.

U.S. War Dept. General Staff



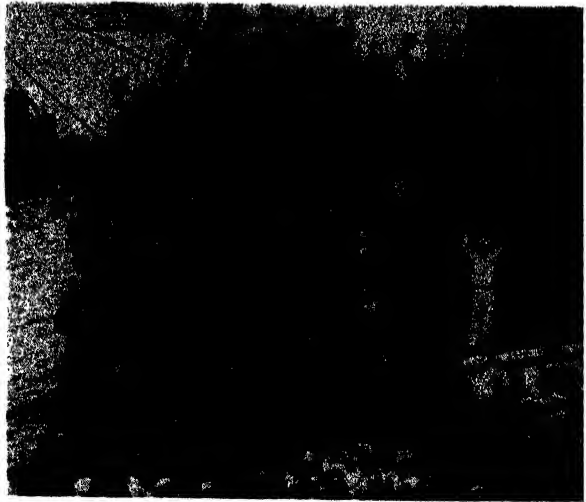
more vigorously the war was prosecuted the sooner it would come to an end, and that, since the economic life of Great Britain was entirely dependent on shipping, it was the duty of the German Navy to strike her in this area. Chancellor Theobald von Bethmann-Hollweg held that it was his duty to make diplomacy succeed, and this view, which had the support of the emperor, prevailed for a time. On March 16, 1916, Tirpitz resigned. Admiral Scheer refused to use submarines against merchantmen in the approaches to Great Britain under the restricted conditions required by international law and withdrew them for use against military targets. In the Mediterranean and in the White Sea off Arkhangelsk the submarine war against shipping continued with considerable success under the restricted conditions.

The submarine policy of the navy was approved by the German people, who wanted to strike at Britain in any way possible. By the end of 1916 it was evident that Germany was not winning the war. After a German offer of peace negotiations had been rejected by the Allies, the naval party received the powerful support of Field Marshal Paul von Hindenburg and Gen. Erich F. W. Ludendorff. The chancellor acquiesced, and on Jan. 31, 1917, the German government announced the resumption of unrestricted warfare after February 1. The United States was left with no choice but to break off diplomatic relations on February 3, and, after several attacks on American ships, to declare war on Germany on April 6, 1917.

The German decision to adopt unrestricted submarine warfare was made on the assumptions that (1) six months of such a campaign would force the British to sue for peace; (2) the United States would probably not become a serious military factor within this time; and (3), if it did, German submarines would prevent American troops from reaching France. None of these assumptions proved valid, but the British people did not know how close they came to defeat until after the war. In the spring of 1917 one ship in four that left Britain did not return, and Admiral Jellicoe, then first sea lord, admitted that the war could be lost by November.

Britain was saved by the convoy system and by German overconfidence. The adoption of a policy of convoying ships rather than patrolling areas had been advocated for some time by a group of younger officers in the Royal Navy, but they could not overcome the opposition of their seniors until they obtained the sponsorship of Rear Adm. William S. Sims, commander of the United States forces in European waters. The Germans put their faith in an all-out effort that would produce very heavy losses in shipping in a few months rather than in a sustained effort over a longer period. All available submarines were sent to sea, maintenance was curtailed, and submarine building was cut back. By the autumn of 1917, however, this gamble had been lost, and resumption of building in 1918 was too late to affect the issue.

Meanwhile, for every submarine unit the Germans put into the attack, the Allies had to muster 20 units to counter it. Reports of submarine losses indicate that 39 percent were destroyed by patrols, 30 percent by mines, and 8 percent by submarines, with aircraft a poor fourth. Casualties in the German submarine service ran as high as 50 percent. Nevertheless,



U.S. Signal Corps

American troops wave farewells as transport ship prepares to leave the United States for France.

submarine crews played no part in the mutinies within the fleet that in large measure brought on the surrender of Germany. They remained loyal to the end.

Proper allocation of shipping was almost as important to the salvation of Great Britain as the convoy system, the antisubmarine weapons, and German overconfidence. In addition to the losses by submarines, a large amount of British shipping had to be withdrawn from trade for military uses. Building programs in the early days of the war were devoted primarily to naval vessels, and until 1918 merchant shipbuilding was never able to compensate for the losses. In the beginning of the war it was impossible to obtain any form of allocation of shipping, and different interests often bid against each other. By 1917, however, most commodities were under government control, and it was possible to set up an agency for the control of shipping with representatives from such users as the War Office, Board of Trade, Ministry of Munitions, and Ministry of Food. War risk insurance was provided to induce neutral merchant vessels to continue trading with the Allies. By 1917 all maritime countries except the Netherlands allowed their ships to be used, and the Dutch ships were taken over by right of angary. German ships interned in American ports were put into the shipping pool after the United States became a belligerent.

The American role in the war at sea was not dramatic. Naval units served as parts of British naval task forces. American destroyers operated out of Queenstown (now Cobh), Ireland, and patrol craft of other types operated elsewhere. United States transports carried a large proportion of American troops to Europe but, despite the demands on Allied shipping, not the major portion. A division of battleships reinforced the Grand Fleet, and another was stationed in Bantry Bay, Ireland, to cover the disembarkation ports of Brest and St. Nazaire.

In summary, Germany's unrestricted submarine warfare, while threatening the Allies with defeat, brought the United States in on their





U.S. Navy

United States Navy vessel helps lay mine barrage in the North Sea in 1918 as a defense against submarines.

side. The defeat of the U-boat by the convoy system made possible the transportation of 2 million American soldiers to France, or enough to offset the collapse of the Russian Army and to assure Allied victory.

See also section 15. *Diplomatic History of the War—The Neutral Nations*; biographies of the leading naval commanders; NAVAL COMMUNICATIONS; SUBMARINE—5. *History of Submarine Warfare* (World War I); SUBMARINE MINES, MINELAYING, AND MINE COUNTERMEASURES—*Mine Warfare*; WARSHIPS.

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#### 14. The War in the Air

The principal national contenders in the air fighting of World War I were Germany, France, and the British Empire; Italy, Austria-Hungary, the United States, and Russia played minor though not inconsequential roles. Of these powers, Germany was the best prepared for the new warfare in the skies, as she was for the traditional battles on the ground. The Germans had prepared methodically and diligently for every foreseeable aspect of war, while Britain slept, and French generals preached that victory was to be achieved by determination and bayonets. Moreover, Germany was a highly industrialized nation, possessing the seed corn needed for air armadas: aircraft factories, skilled artisans, and better aircraft and engine designs than those of her rivals.

France stood next in capacity for air warfare. Her people had shown tremendous interest in the first European flights of the Wright brothers near Paris, had reacted enthusiastically to the exploits of the Brazilian Alberto Santos-Dumont, and had taken great pride in their own air pioneers, such as Louis Blériot and Henri Farman. Moreover, France was not far behind Germany in number of aircraft and in size and number of aircraft factories.

Great Britain had had fewer outstanding early pilots and engine builders. Her air industry was so underdeveloped that her first five air squadrons sent to France in August 1914 (all she had at

the time) were equipped largely with <sup>planes</sup> and engines of French design. At the same time, she was a highly industrialized nation with large numbers of skilled workers.

The Austrian and Italian air forces were of less importance (note that Italy did not become a belligerent until May 1915), though the Italians were the first to employ airplanes in warfare, having used them to drop a few crude bombs on Arab tribesmen during their conquest of Libya in 1912. The Russians had experimented with unusually big airplanes but without much success, and their small air force consisted largely of French planes.

Although it had been two American citizens, Wilbur and Orville Wright, who had made the first successful heavier-than-air (airplane) flight, the United States remained surprisingly apathetic toward aviation in general and the 1914-1916 air operations in Europe in particular. Even the glaring deficiencies shown by the 1st Aero Squadron, which (equipped with 16 training planes) had accompanied Brig. Gen. (later General of the Armies) John J. Pershing's expeditionary force into Mexico in 1916, failed to rouse either military or industrial leaders to corrective action. Consequently, when the United States finally declared war on Germany in April 1917, it did not have a single combat airplane. American aviators had to be trained in French and British schools and fly French and British aircraft.

While the major air operations of World War I took place over the battlefields of France, military aviation also played a valuable part in the operations in northern Italy. The Germans used aircraft effectively in their defeats of the Russians along the eastern front, and the employment of airpower by Gen. Sir Edmund Allenby (later 1st Viscount Allenby) against the Turks in Palestine remains a classic example of the proper use of aircraft in mobile warfare.

The air phase of World War I can be best understood by a consideration of the basic elements of air fighting: men, machines, organization, and tactics.

**The Men.**—Man has always been the prime element in war; he initiates it, directs it, fights its battles, and designs and builds its weapons. In any military operation the leader is likewise all important, but World War I found its fledgling air forces practically leaderless. Military aviation was less than 10 years old. Military history and doctrine were replete with examples of great generals and famous admirals, but in all the annals of warfare there was not a single page on the planning and conduct of air operations. Officers and men were as little tested as their equipment. Leadership had to be established by competence and survival in action.

From the first this challenge attracted men of daring and energy from other branches of the armed forces and from civil life. The aviators of the opposing armies were volunteers, picked for physical fitness and eager to match themselves against the risks of this new sort of war. They rode frail, underpowered craft into a strangely different field of battle, where the impersonal forces of wind, weather, and lack of oxygen could be more deadly than the human enemy. There were no trenches for protection but only a chance cloud or the sun's glare for momentary concealment—no safe place to hide—in the empty reaches of the sky. The aviator often fought

and died alone. Even his training was full of hazards: more fliers lost their lives in training than in combat. Typical of the breed of fighting men that air warfare attracted was the Lafayette Escadrille, composed of American adventurers and idealists who volunteered for service with the French early in the war and established an excellent combat record.

The air force commanders who came up through this stern testing were mostly young, enthusiastic, and aggressive. The outstanding personality among them undoubtedly was Maj. Gen. (later Air Chief Marshal) Sir Hugh Trenchard of Great Britain, now generally recognized as the founding father of modern airpower. A commander of intelligence, vision, and method, able in presenting his views, he built the Royal Air Force into the most efficient air service in Europe. Brig. Gen. Maurice Duval of France, the expert Lt. Gen. Ernst von Hoeppner of Germany, and Col. (later Maj. Gen.) Giulio Douhet of Italy all achieved distinction as skilled air force commanders and prophets of the coming greatness of air power. Brig. Gen. William Mitchell showed considerable talent in directing the operations of the American air units in France; a convinced disciple of Trenchard, he later devoted his life to championing the airplane as the decisive weapon of future wars.

Initially, air fighting was a thoroughly individualistic affair. Fliers kept scores of their kills, those in the Allied air forces with five or more to their credit being termed "aces." Some became legendary figures—William Avery Bishop, the Canadian; Georges Marie Guynemer, the French ace who scorned maneuvering, always attacking with headlong fury; Manfred von Richthofen, the "Red Knight" of Germany; Albert Ball, the deadly Englishman; the Americans Raoul G. V. Lufbery and Edward V. Rickenbacker—and Edward Mannock, Oswald Boelcke, Max Immelmann, René Fonck, Frank Luke, Jr., and many others.

Less publicized and therefore seldom known to fame were the pilots and observers who performed the humdrum but vital tasks of adjusting artillery fire, photographing enemy positions, and scouting far behind enemy lines, their slow lumbering planes often easy victims for enemy fighter pilots. The bomber crews, harried by enemy fighters and antiaircraft guns by day and risking weather and navigational errors (their instruments being few and crude) by night, also served largely unnoticed. Possibly the most risky of the airmen's missions was that of the crews of the observation balloons, hung defenseless between earth and sky as they watched for telltale enemy activity and directed artillery fire.

Through all this dangerous duty, above the bloody grapplings in the mud below, ran a thin gleam of the chivalry of older wars. An opponent whose guns had jammed in an aerial dogfight might be (if rarely) spared. Messages might be dropped over an enemy airdrome, telling of the fate of a pilot missing from it. The average aviator might occasionally be charged with indiscipline, but he normally was nevertheless a ready, self-reliant fighting man.

**The Machines.**—Most of the World War I air operations were carried out by heavier-than-air machines (airplanes). All armies made extensive use of lighter-than-air observation balloons, however, and most of them had experimented with various types of dirigibles. The Germans had

done the most outstanding work in this last-named field and had developed a fleet of large, rigid-type dirigibles (the famous zeppelins). Excellent weight lifters capable of cruising long distances (one of them made a successful 96-hour, 4,225-mile, nonstop flight between Bulgaria and northeastern Africa in November 1917), these impressive aircraft initially scored considerable success. Their size and relatively slow speed made them increasingly vulnerable to the Allies' constantly improving fighter airplanes and antiaircraft artillery, however, and they lacked the structural strength to withstand severe storms. These weaknesses resulted in their being gradually driven from the skies.

The typical military airplane at the beginning of World War I was unarmed, slow, fragile, and mechanically unreliable—hardly beyond the experimental stage and capable of carrying only enough fuel for a short flight. Exact figures are not available, but it is probable that all the original belligerents together could put less than 2,000 serviceable machines into action. In addition, most of the so-called aircraft factories operating in 1914 (Germany was credited with about 12, France with 8, and Britain with 6) were merely small shops, employing a few hundred skilled artisans. Airplanes were built largely by hand on a cut-and-try basis. There was nothing comparable to the tremendous shipbuilding and armament industrial complexes which provided weapons for the sea and land forces of the period. Aircraft engines were inefficient and heavy for the power they delivered, averaging six to eight pounds of weight per horsepower.

From this primitive stage the brutal necessities of war and the increasing appreciation of the potential importance of air operations soon led to dramatic improvements in airplane design and production. The nondescript general-purpose plane of 1914 began to evolve into several new types designed for specific functions. Swift fighter planes, generally single-seaters (though some of the most effective British fighters were two-seated models), were employed to hunt down other aircraft. These fighter aircraft—such as the French Nieuport and Spad, the British Camel, and the German Fokker—shared the fame of the aces who flew them and are probably the best-remembered aircraft of the war. The two-seater observation planes were slower but usually had a longer range; by 1918, German observation planes could operate at higher altitudes than could most Allied fighters. Frequently they carried special cameras for aerial photography of enemy positions or primitive radio equipment for the direction of artillery fire.

The resulting race for air supremacy over the western front produced series of improved planes on both sides. Speeds became greater, ceilings (the maximum height at which the plane could operate) were pushed upward, and the rate of climb increased. Air battles demonstrated that airplane quality and performance were even more important than total numbers. Air superiority shifted back and forth between the two sides as new types of aircraft were introduced and tactics developed to exploit their particular capabilities. In 1916, for example, the British ruled the skies over the Somme battlefield; nine months later, in the spring of 1917, Hoeppner had wrested it from them. On the whole, the planes of both sides were fairly evenly matched,

neither being able to maintain any distinct superiority in plane and engine construction, though the Germans might be credited with slightly greater technological aptitude.

In 1915 the machine gun became the standard weapon for airplanes, though the problem of how to mount these weapons so as to obtain the most effective use of their firepower took considerable time to solve. Some fighter aircraft carried a light machine gun (such as the British Lewis gun) mounted in the center of their top wing in order to give fire forward above the propeller. A French flier obtained greater accuracy by mounting a machine gun just in front of his cockpit, so that it could fire directly through the rotating blades of his plane's propeller. This enabled him to aim his gun simply by pointing his plane at his opponent; light armor on the inner surface of the propeller gave that vital part rough-and-ready protection from such bullets as struck it. German technical skill made this concept obsolete by developing a system of mechanical linkages which synchronized the revolutions of the propeller and the rate of fire of the machine gun. This system was soon copied by the Allies and became standard equipment on fighter planes, though some still retained the machine gun on the top wing. Observation planes and two-seater fighters were variously armed; usually the pilot had one or two fixed guns mounted like those on the fighter aircraft, and his passenger had one or more movable guns. Since increasing attention was being given to all-around protection, one of these might be mounted so as to fire through the floor of the rear cockpit. A few special fighters carried heavy machine guns or even light cannon; airplane armor made its first tentative appearance.

By 1917 the aircraft industry began to develop the skills necessary to turn out larger aircraft designed primarily for bombing. Previously, some observation planes had been modified so as to carry light bombs slung under their wings. Smaller bombs had been carried in the cockpit and dropped hopefully overside by hand; the French had tried but abandoned the idea of scattering showers of steel darts called *fléchettes*. Some of the new bombers, such as the British DH series, were still modified observation craft. Others were big, slow biplanes like the British Handley Page bomber, the Italian Caproni, and the German Gotha. The Handley Page, which came too late to take a serious part in the air war, was capable of carrying sixteen 112-pound bombs and fuel for an eight-hour flight. These bombers, in turn, were subdivided into day and night bombing planes; generally speaking, the former were lighter and faster, the latter slow but capable of carrying a much greater bomb load.

Naturally, this increase in airplane numbers, types, and capabilities could be brought about only through an unparalleled development of the aircraft industry. That of France and Britain grew steadily, and the French effort especially (though plagued by a multiplicity of plane and engine types) was so well directed that France was able both to supply her own needs and to furnish large numbers of excellent aircraft to her allies. Germany, thanks to an early start and a broad industrial base, could outproduce either France or Britain until early in 1918. Thereafter, diminishing raw materials and heavy demands for munitions for the German Army prevented

her efficient aircraft industry from keeping pace with her losses in combat.

The United States aircraft industry was of necessity hastily built from the ground up after the American entry into the war. By agreement with its allies, the United States furnished their aircraft industries with needed raw materials (sprucewood, linen, chemicals, fuels, and lubricants); in exchange, Britain and France trained American fliers and mechanics, and France provided planes for the first United States air squadrons. Since fighter aircraft were evolving so rapidly that any selected type would be obsolescent before it could be put into production in the United States, it was further agreed that the United States would produce the DH-4 (a sturdy, British-designed plane used as an observation plane and as a light bomber) for all of the Allies, and would in addition develop and produce a new type of engine (dubbed the Liberty engine) in ample quantity to satisfy its own DH-4 production and French and British requirements. American production got under way too late to be of importance, but it could have been a considerable factor had the war continued into 1919.

By the war's end approximately 8,000 Allied planes were arrayed against 3,300 enemy aircraft. Back of the men who flew these aircraft were the much larger forces of mechanics, armorers, and supply personnel in the service parks and repair depots behind the lines. The importance of their work can be understood when it is realized that an airplane of this period lasted only a few weeks in combat. Thereafter, even if not destroyed, it normally required extensive repairs. A significant figure is available to illustrate this fact: the British had 1,300 planes operating in support of their armies at the beginning of the Second Battle of the Somme. When the fighting ended a few weeks later, 1,100 of the original 1,300 planes had been destroyed or damaged and had to be replaced.

It should be noted that though the major emphasis in World War I was on air operations in support of the armies, the contending navies steadily developed their own air elements for overwater scouting, fire direction, and bombing attacks on submarines and surface ships. Originally, the aircraft used were seaplanes, which operated from established naval bases. Later, battleships and cruisers began to carry one or more light planes, and fast merchant vessels were converted into seaplane carriers which could accompany the fleets on extended operations. Since seaplanes lacked the speed and maneuverability of land-based planes, the British eventually developed the first modern aircraft carrier (commissioned into the Royal Navy in October 1918), capable of both launching and recovering the latter type. Probably naval aviation's most valuable mission during the war was its antisubmarine work, a task for which dirigibles proved very satisfactory.

**Organization.**—In 1914 the airplane was still a new and unproved auxiliary to the armies and fleets. Its intended missions were observation, reconnaissance, and courier duty—functions generally viewed as extensions of the conventional military signal communications systems for lack of a more definite classification to assign them. Consequently, the Germans grouped their air service with railway troops and signal units; a communications troops, and the French Army

and Navy administered their respective aviation elements as subdivisions of their communications services. In the United States military aviation was a responsibility of the Signal Corps from 1907 to 1918, when the Air Service was organized. (In June 1917, General Pershing had already detached the aviation units serving in France from the Signal Corps, reorganizing them as the Air Service, American Expeditionary Force.) Britain had followed a far different course, combining all of its aviation units into a Royal Flying Corps, but on July 1, 1914, just before the outbreak of the war, this force was broken up. The Royal Navy set up its own air force under the title of the Royal Naval Air Service, while the Royal Flying Corps became merely the air arm of the British Army, where it had equal status with the cavalry, infantry, and other combat arms.

As the war progressed and the importance of military aviation became more firmly established and more generally recognized, its management gradually moved to higher levels. Britain again led the way. By 1918, largely as a result of German air raids (first by zeppelins and later by Gotha bombers) on London, popular dissatisfaction with Britain's air defenses had led to protests in Parliament. Cooperation between the Royal Flying Corps and the Royal Naval Air Service had been limited; moreover, the two groups were struggling bitterly over the limited supplies of planes, engines, and personnel available. On the advice of a board headed by Lt. Gen. Jan Christiaan Smuts (who was strongly supported by his fellow member, Winston Churchill), a separate Air Ministry was set up in the British government in December 1917. This placed its head, the air minister, in the War Cabinet as an equal partner (as least in theory) of the secretary of state for war and the first lord of the admiralty. Furthermore, in April 1918 the Royal Flying Corps and the Royal Naval Air Service were recombined into the Royal Air Force, which was given equal status with the Royal Navy and the British Army.

Both France and Germany continued to retain their air services as organic parts of their armies and navies, but both established subcabinet posts (assistant secretaries or undersecretaries) to coordinate the administration of such matters as engine and aircraft construction, allocation of personnel, and formulation of military aviation budgets.

In the United States a series of tentative reorganizations in May 1918 had at last converted the Signal Corps' Aviation Section into the independent Air Service, but had divided the necessary authority between a director of military aeronautics and a Bureau of Aircraft Production. Within three months aircraft production was in such chaos that the post of second assistant secretary of war was created to provide an official with sufficient authority to untangle it. At the same time, this secretary functioned as director of the Air Service and so was able to deal with military aviation problems as a whole.

On the fighting fronts the organization of the various air forces was very similar. Each national commander had a senior air force officer as his adviser on all matters relating to military aviation. Thus in the American Expeditionary Force (organized according to French and British experience), General Pershing's Air Service was commanded by Maj. Gen. Mason M.



Imperial War Museum, London

London ambulance women aid in defense measures against zeppelins, which raided the city in 1915 and 1916.

Patrick; General Patrick, in turn, had General Mitchell as his assistant for operations and Brig. Gen. Benjamin D. Foulois as an assistant for training and supply. At the next lower level of command each army commander had an aviation officer as a member of his staff. These officers coordinated air operations for their respective commanders, prescribed tactics, negotiated for flying fields, and allocated supplies and replacements.

The basic air force tactical organization was the squadron, usually composed of aircraft of one type only, and so designated as a fighter, observation, bomber, or service squadron. Fighter squadrons were equipped with approximately 18 planes, observation and bombing squadrons with 12. A fighter squadron would have from 20 to 25 aviators, and observation and bombing squadrons as many as 50, including observers and bombardiers. In addition, each squadron had 100 to 150 ground crew personnel. The service squadrons were responsible for the logistical support of the combat squadrons.

It was usual for squadrons to be assigned to the direct support and operational control of armies, where (as noted above) their operations would be coordinated by the aviation staff officers concerned. As the war progressed, the need for larger and more flexible air commands developed, and squadrons would accordingly be formed into groups, and these groups on occasion were assembled into wings. As a climax, in 1918 the French organized most of the planes which could be spared from their hard-pressed armies into an aviation division of 432 fighters and 193 day bombers, thus establishing a strong, mobile force which could be readily shifted to

any part of the western front to meet an emergency or exploit an opportunity.

Also in 1918, General Trenchard established his famous Independent Air Force (average strength, approximately 75 day bombers, 49 heavy night bombers, and 16 fighters) with the mission of bombing rail and industrial centers behind the German front. This was the first strategic air force to be established. Hindered in its avowed primary mission by bad weather and heavy losses, it still furnished a powerful air reserve. (It should be noted that this force did not utilize mass air attacks, such as became common in World War II.)

In October 1918, Trenchard was organizing an Inter-Allied Independent Air Force, made up of contingents from all of the Allied air forces, to support the projected 1919 campaign by air strikes deep into Germany. As the commander of this force, Trenchard was to operate under the direct control of Marshal Ferdinand Foch, the Allied commander in chief. The armistice of Nov. 11, 1918, scuttled his hope of leading it on raids against Berlin.

**Tactics.**—In the early months of World War I airplanes were commonly employed as scouts, with varying success. As they sought out the enemy's forces, they often passed enemy planes bound on similar missions. At first, pilots and observers might wave to opposing crews as they met, if not as a greeting, at least in recognition. It was soon realized, however, that these missions were important to the enemy's operations and should be opposed. Aviators began to arm themselves with odd collections of rifles, shotguns, and pistols and to make clumsy efforts to intercept and destroy enemy aircraft. Improvement of airplanes and weapons made these clashes increasingly deadly, and fighter aircraft tactics rapidly became the largest phase of air operations.

As fighter planes took an increasing toll of the slower observation planes, the latter were sent out under the escort of friendly fighters. In early 1916, however, the French discovered that their fighters could be more effectively employed on offensive patrols over the enemy's lines to search out, surprise, and shoot down the enemy fighters—and even, if possible, to attack German forward airdromes. By thus gaining local air superiority and keeping the enemy on the defensive, the French fighters enabled their observation planes to operate freely without escorts. During the Battle of the Somme that same year the British employed this technique aggressively and systematically and achieved outstanding success.

The actual tactics of these air battles were quite simple. Underpowered and fragile, the planes of the period had an inconvenient tendency to come apart if subjected to violent maneuvering. Successful pilots usually sought to gain altitude, diving "from out of the sun" on enemy aircraft passing below them and trusting to speed and surprise. Planes patrolled singly or in small groups, attacking any enemy aircraft encountered in their assigned area.

The size of the tactical units involved in these operations grew steadily, if slowly. In this, as in so many other aspects of air warfare, the methodical Germans seem to have set the example, employing strong units of picked fighters—such as Richthofen's famous, gaudily decorated "circus"—at critical points. By 1918 for-

mations of 50 fighters were not uncommon. A clash between two such groups could lead to a wild, scrambling dogfight—a mass of confused individual engagements in which each fighter sought to get "on the tail of" (behind) his opponent.

Initially, as previously mentioned, squadrons were assigned to armies and so were tied to their areas of operations. During the later stages commanders on both sides began to realize that the inherent mobility of aircraft permitted their concentration at the decisive point of the battle, and accordingly would assemble all available air strength to support the divisions spearheading the attack. As an example, the American St.-Mihiel offensive was supported by both the British Independent Air Force and the French Aviation Division, as well as by American, Italian, and Portuguese aircraft. Once the operation had been successfully concluded, most of these planes were shifted to other sectors of the front to support other operations.

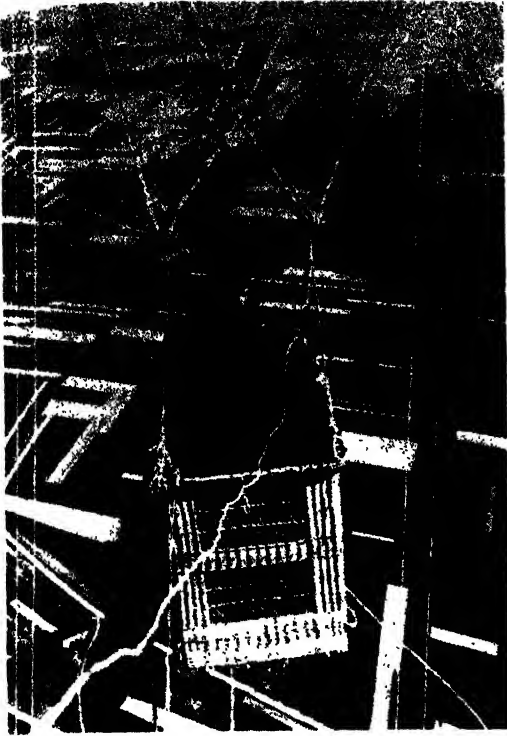
The observation planes naturally worked more closely with the ground forces than did the fighter planes. The development of effective aerial cameras enabled army commanders to keep constantly abreast of changes in the enemy's defenses and dispositions. Eventually thousands of aerial photographs were distributed to infantry divisions to replace outdated maps. Likewise the development of radio equipment greatly improved air-ground communications and made it possible for air observers to direct artillery fire effectively. Since artillery fire was the backbone of both offensive and defensive operations during this period, the importance of this service can easily be appreciated. In this mission the airplane was effectively supplemented by the cap-

A rare shot of a dogfight on the western front between German (marked with black cross) and British airplanes.

The Bettmann Archive







U.S. Signal Corps

United States observation balloon, used in artillery spotting, is manned by an American officer.

tive observation balloon. Though unable to attain the height to which observation planes could climb or to fly over enemy-held territory, the balloon had the advantages of a fixed position (which enabled its observer to orient himself more exactly) and of direct telephonic communication with the artillery units it served. The natural vulnerability of its big bag of inflammable hydrogen gas was at least partially compensated for by emplacing it in a ring of antiaircraft weapons.

During 1917-1918 a new aerial technique, commonly known as the attack mission, appeared. Besides gaining air superiority in the skies above the battlefield, fighter aircraft were made responsible for attacks with machine gun fire and light bombs against enemy ground forces. Attack aviation was frequently employed against the enemy trench system in support of assaults by friendly infantry. It was very effective against troops and vehicles caught in railroad yards or on the march. If the enemy were retreating through rough country where frequent defiles made it difficult for his troops to deploy off the road, the results could be devastating. In 1918, Italian and British aircraft mauled the Austro-Hungarian forces retreating after their defeat at Vittorio Veneto. French fliers pounded the retreating Bulgarians in the Balkans, and Allenby's air force broke up large elements of the Turkish troops retreating before him in Palestine. Possibly, however, the greatest success of attack aviation occurred in March 1918, when all possible Allied aviation was committed (as the only mobile reserve available) to check

victorious German columns following up the retreating British Fifth Army. Employed energetically, Allied airmen gained time for Allied ground forces to patch their broken front.

Though some military leaders had for years visualized the possible use of aircraft as bombers, World War I bombing operations were of relatively little importance. Neither satisfactory planes, bombs, navigational instruments, nor bombsights were available. The bombing planes employed were too slow and usually lacked sufficient range to reach vital enemy targets. Despite the courage of the bomber crews, neither day nor night raids met with outstanding success. The German raids against the London area did force the withdrawal of some of the best British fighter units from France for home defense, but the Germans found their losses dishearteningly heavy. Bombing operations proved most useful when directed at enemy communications close behind the front during major ground offensives.

There were occasional instances of the air supply of ground troops, both in dropping food and ammunition to cutoff units and in the use of zeppelins or heavy bombers to move supplies to hard-to-reach areas of Africa or Asia Minor.

In general, both sides learned that air superiority was hard to win and was seldom complete. In 1917 and 1918, by securing strong air support, Allenby was able to destroy the Turkish-German air units opposing him in Palestine and so to blind the Turkish ground forces. This enemy aviation was weak numerically and qualitatively, however, and was isolated beyond the hope of effective reinforcement. In contrast, on the western front the Germans remained able even in 1918 to secure local air superiority by hurriedly concentrating their remaining picked fighter units.

In the air, as on the ground, retention of the initiative proved decisive. Though ground commanders might protest, it was repeatedly proved that better results could be obtained by concentrating friendly aircraft for offensive action against enemy aircraft and airbases than by parceling them out for the defense of assigned sectors of the front.

**Significance of Air Warfare.**—A new dimension had come to warfare; as Napoleon had predicted, "He who holds the high ground will win." The true lessons of World War I air warfare, however, were blurred by the fact that the aircraft employed, despite amazing improvement during the four years of combat, never achieved the desired level of technological development. Like the tank, they remained short-ranged, relatively slow, and mechanically unreliable weapons, seldom capable of independent action, and therefore only auxiliaries (if important ones) of the infantryman and the gunner. Only a few military leaders had the vision to see the future possibilities of either of these emerging weapons, although 21 years later, the air-armor team swept across Europe, and air superiority became the key to victory.

World War I trained the air force commanders of World War II: Hermann Goering, Sir Charles Portal, Arthur Travers Harris, Henry H. Arnold, Carl Spaatz, and many others. It taught hard lessons for those willing to learn: the need for a strong industrial base, ready for quick conversion from peacetime manufacturing to the production of air armaments; the importance of keeping planes and engine types to a

minimum, both to speed up aircraft production and to simplify problems of maintenance and supply; and the value of vision and imaginative leadership. Above all it demonstrated that, in Trenchard's words, "the airplane is an offensive weapon."

See also AERONAUTICS—1. *History* (World War I); MILITARY AERONAUTICS—*World War I*; NAVAL AVIATION—*Evolution of Naval Aviation* (World War I).

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## 15. Diplomatic History of the War

### NEGOTIATIONS DURING THE WAR

At the outbreak of war in 1914 the German and Austro-Hungarian empires were united by an alliance that dated back to 1879. Though each of the two governments declared war separately on the common enemies and neither invoked the formal alliance, both emperors declared that the two states would fight together to the end, neither making peace without the other.

Of the nations on the opposing side, only two, France and Russia, were formally allied. The British government had understandings with both, but was not committed to join them in war, and in fact the London cabinet debated for several days before deciding on its course. Then, on August 4, Britain declared war against Germany not because France and Russia had done so, but because Germany had invaded Belgium, and Belgian neutrality was guaranteed by an 1839 treaty of which Britain was one of the signatories. On Sept. 5, 1914, however, the British, French, and Russian governments signed the Pact of London (see LONDON, PACT OF), pledging themselves to make no separate peace. The three powers which before the war had formed the Triple Entente (q.v.) thus became allies. In addition, each entered into comparable engagements with other states fighting the Central Powers: Serbia, which had been the first belligerent; Montenegro, which was Serbia's ally; Luxembourg, which the Germans invaded on Aug. 2, 1914; and Belgium. Portugal affirmed her long-standing alliance with Britain, even though the Central Powers did not formally declare war on her until 1916. All these states together were known as the Allies.

**Japanese Intervention.**—Within a month after the declarations of war in Europe, Japan joined the Allies. Though the British government advised Tokyo that it did not interpret the Anglo-Japanese alliance (q.v.) of 1902 as requiring Japan to enter the European war, hostilities at sea were soon extended to the Pacific, and the British Dominion governments in Australia and New Zealand made it clear that they meant to seize Germany's possessions there. The Japanese government volunteered to enter the war. The British Foreign Office then suggested that the Japanese might confine their operations to the Pacific and not attack the German leasehold of Kiaochow in China, but Japan was not receptive to this proposal. On August 15, it dispatched an ultimatum to Berlin, demanding the withdrawal of German naval craft from Japanese and Chinese waters and the unconditional surrender of the leasehold, "with a view to eventual restoration of the same to China." The seven-day time limit expired without Germany's replying; on August 23, the Japanese government

formally declared war; and in October it announced its adhesion to the Pact of London, thus becoming one of the great Allies and pledging itself to negotiate no separate peace.

**Turkish Intervention.**—The adherence of Japan to the Allies was soon offset by Turkey's intervention on the side of the Central Powers. Though Britain had traditionally been a supporter of the Ottoman Empire, and British and French firms had large investments in Turkey, German influence had been rising steadily. The Young Turks who had seized power in 1908 regarded the existence of British and French spheres of influence in the Levant as inimical to their pan-Turkish aspirations; they also considered Russia their chief enemy in the east, the Black Sea, and the Balkans. Their leaders, War Minister Enver Pasha, Interior Minister Mehmet Talaat Pasha, and Navy Minister Ahmed Djemal Pasha, were admirers of Germany, and in 1913 the Turkish government had agreed to have its army reorganized by a German general, Otto Liman von Sanders. In July 1914, Enver went to Berlin and there negotiated a secret treaty of alliance (signed August 2), by the terms of which Turkey was to become a belligerent, receiving in compensation portions of conquered Russian territory and, if Greece and Bulgaria entered the war on the opposing side, parts of their lands as well. Turkey was to remain neutral, however, until she had had an opportunity to ready her defenses.

After the outbreak of hostilities the Allies made some effort to induce Turkey to perpetuate her neutrality. The British government commandeered two warships that were being built in England for the Turkish government, but at the same time allowed two German warships, the *Goeben* and the *Breslau*, to slip through the Dardanelles and be transferred by Germany to the Turkish government. The British prime minister, Herbert Henry Asquith, remarked privately that international law would require the Turks to man the vessels with their own men, and "Turkish sailors cannot navigate . . . except on to rocks or mines." Meanwhile, British, French, and Russian diplomats suggested to the Ottoman government that agreements might be worked out under which Turkey would receive concessions in return for her neutrality.

But the Young Turks soon dispelled any doubts about their ultimate intentions. They retained German crewmen on the *Goeben* and *Breslau*, merely putting them into Turkish uniforms. When the Allied governments protested, the Porte ordered all British seamen dismissed from the Turkish Navy and appointed a German as commander in chief of the Turkish Fleet. At the instigation of Enver the Turkish press opened a violent campaign against the Allies and in favor of the Central Powers. On Oct. 29, 1914, a Turkish fleet bombarded the Russian coastal cities of Odessa, Sevastopol, Feodosiya, and Novorossisk. The Allied governments demanded that the Turks make reparations and dismiss all Germans from their forces. After the Turks had refused to do so, the major Allies recognized a state of war (Russia on November 1, and Britain and France on November 5), and Turkey became a cobelligerent with Germany and Austria-Hungary.

**Italy's Entry into the War.**—The great prize among European neutrals was Italy. With Ger-

many and Austria-Hungary, it had been a partner in the Triple Alliance (q.v.), but for some time it had been drifting away from this tie. When the war opened and the German and Austrian governments asked Italy to join them, the Italian cabinet refused on the technical ground that Article 7 of the alliance treaty required consultation and agreement concerning any territorial change in the Balkan area, and that Vienna had not consulted Rome before making demands on Serbia. On August 3, the Italian government issued a proclamation of neutrality. From the outset, however, it was evident that Italy would probably at some point abandon this status and join either the Central Powers or the Allies. Conservative and colonialist groups in the country favored the former, reasoning that an Allied victory would strengthen liberalism in Italy, give Britain total control of the Mediterranean Sea and thus check future growth of the nation's African empire, and place Russia in such a commanding position in the southern Balkans as to halt Italian expansion there. Liberal, commercial, and nationalist groups leaned toward the Allies, fearing that conflict with Britain would strangle Italian trade, and believing that Italy's wisest policy was to seek the annexation of Austro-Hungarian territories populated by Italians.

The prime minister, Antonio Salandra, was of the latter view. As early as Sept. 30, 1914, he reported to King Victor Emmanuel III that Italy's only real choices were to remain neutral or to join the Allies, and that war against Germany and Austria-Hungary would be the most profitable course, but that hostilities should not be opened until spring, when the army would have had time to prepare for an offensive. Salandra did not, however, have the full support of the Italian people or even of a majority of the Chamber of Deputies. Three fourths of the deputies were supporters of his predecessor, Giovanni Giolitti, who for obscure reasons had resigned his office in March, and Giolitti was not committed to the Allied cause. In public, therefore, Salandra confined himself to declaring on October 18 that the government would be "uninfluenced by any sentiment but that of an exclusive, unlimited devotion to our country, a sacred egoism [*sacro egoismo*] for Italy," and on December 3 that it would maintain "an alert and armed neutrality." For his part, Giolitti adopted a quasi-neutralist position, asserting in January 1915 that "much [*parecchio*] may be obtained without going to war." These rival slogans, "*sacro egoismo*" and "*parecchio*," ornamented Italian partisan debate throughout the winter of 1914-1915.

The Allies and the Central Powers assumed that Italian favors were up for auction. The German General Staff, already alarmed by Austria's inability to make headway against the Russians on the Carpathian front, feared that Italian intervention would be followed by intervention on the part of Rumania, Bulgaria, and Greece, and that, at the very least, this would require a substantial diversion of German troops from the French and Russian theaters. German military and civilian authorities consequently bent every effort to persuade the Austrians to offer concessions to Italy. They encountered strong resistance in Vienna. When Austrian Foreign Minister Count Leopold von Berchtold agreed to contemplate such a policy, he was ousted by intran-

sigents in the imperial government and replaced in January 1915 by one of their own number, Count Stefan Burián von Rajecz. But even Burián was compelled eventually to yield ground. The German government dispatched former Chancellor Prince Bernhard von Bülow as a special ambassador to Rome, and he was presently authorized to offer the Italians territory from the Austrian borderlands as well as promises of economic concessions and future grants from the British and French empires. He also encouraged neutralist journalists and entered into secret conversations with Giolitti. Another special German envoy, Roman Catholic Center Party leaders Matthias Erzberger, meanwhile appealed to Pope Benedict XV and to Italian Roman Catholics to help keep Italy out of the war.

The Allies were no less active. They subsidized journalists who advocated intervention on their side; one was the editor of the Socialist *Avanti*, Benito Mussolini. Their diplomats warned the Italian government that the Central Powers were not to be trusted and hinted that intervention on the Allied side would bring Italy large pieces of Austrian territory and a dominant position in the Adriatic Sea. The British and French were compelled at first to be vague in their promises, for the Russian government backed Serbia's ambition for a great Yugoslavia and insisted that Serbia had first claim on the Allies. Planning for their attack on the Dardanelles early in 1915, however, the British became more and more convinced that Italian intervention was urgent; they threatened the Russians with possible curtailment of financial and other aid. Czar Nicholas II's ministers gave in. As a result, the three Allies were able to sign with Italy on April 26, 1915, the secret Treaty of London (see LONDON, TREATY OF [1915]). By its terms, Italy was to enter the war on the Allied side and be rewarded subsequently with the Trentino; the Tirol to the Brenner Pass; Trieste; Görz (Gorizia); Gradisca; the Istrian Peninsula and adjoining islands; Dalmatia; such ports on the Adriatic coast as were not already assigned to Montenegro or Serbia; control over the foreign relations of Albania; recognized sovereignty over the Dodecanese, which Italy had occupied since 1912; the province of Antalya (Adalia) in Turkey, when and if Turkey were partitioned; and shares in the indemnity imposed on the Central Powers and in any African colonial spoils.

Salandra had decided in February to negotiate such a treaty. Nevertheless, he had continued through March and April to discuss possible terms with the Central Powers, constantly increasing his demands as the Germans and Austrians appeared to yield. Then, on May 3, 1915, he showed his hand. He formally denounced the Triple Alliance and notified Berlin and Vienna that Italy was regaining her freedom of action. On May 13, having failed to obtain unanimous support from his cabinet for intervention, he resigned. Giolitti refused to take power, however, and chauvinists led by the poet Gabriele d'Annunzio clamored for war. On May 16, the king advised Salandra that he could not accept the resignation; Salandra resumed office; and on May 23, the Italian government formally declared war on Austria-Hungary. Subsequently, on November 30, it proclaimed its adhesion to the Pact of London. Italy had joined Britain,

France, Russia, and Japan as one of the great Allies.

**Bulgaria.**—On the very day of Italy's declaration of war, the Central Powers made a formal bid for Bulgaria's friendly neutrality. Though reduced in territory as a result of the Balkan Wars (q.v.) of 1912–1913, that nation still commanded the principal communication lines between Austria-Hungary and Turkey; its intervention on the Allied side would require Austria to divert substantial resources from the Russian front and the Italian frontier and would make it much more difficult for Turkey to resist the British in the Dardanelles. Consequently, the Central Powers dangled before the Bulgarian government the promise of a heavy loan, the prompt cession of Serbian Macedonia, and the transfer to Bulgaria of the lands she had lost to Greece and Rumania if those states should intervene on the Allied side.

The Bulgarian government already leaned toward the Central Powers. The Bulgarian king, Ferdinand I, was a German prince who had favored joining Germany and Austria-Hungary from the outset of the war. The premier, Vasil Radoslavov, had merely insisted on waiting until a favorable opportunity presented itself. With the offer of the Central Powers in hand, Radoslavov became less cautious. On May 29, he received a counterproposal from the Allies, offering Bulgaria part of Serbian Macedonia, Thrace to the Enez-Midyne line, and Kavalla, and promising in addition to "regulate" the long-standing Bulgarian-Rumanian conflict over Dobruja. Attractive though these terms might have been, they were all contingent on the agreement of Serbia, Greece, and Rumania and on the ability of the Allies to compensate those states elsewhere. Ferdinand and Radoslavov realized that the Central Powers, if victorious, would be in a better position to reward Bulgaria, and they continued negotiations with Berlin, Vienna, and Constantinople. In July, they secured from Turkey a concession forced in their behalf by the Germans and Austrians. Turkey ceded to Bulgaria, in a treaty ratified on September 22, the land west of the Maritsa and both banks of that river, except for the city of Edirne (Adrianople). Meanwhile, on September 6, the Bulgarian government agreed to a secret alliance with Germany and Austria-Hungary. By its terms, Bulgaria was to join in operations against Serbia and was in compensation to receive after the war all of Serbian Macedonia and most of northeastern Serbia as far as the Morava River; if Greece and Rumania entered the war, Bulgaria was also to receive the lands lost earlier to them.

As German and Austrian forces mobilized for a southward offensive, the Serbs yielded to urgent pressure from the British and French and offered Bulgaria immediate concessions in Macedonia, but the Bulgarian government was not deterred from its course. In October 1915, when the forces of the Central Powers struck the Serbian lines, Bulgarian troops joined them. Bulgaria declared war on Serbia on October 14, and within a few days Serbia and the other Allies declared war on her.

**Rumania.**—At the time of Italy's intervention in the war, Rumania had almost thrown in her lot with the Allies. The pro-German king, Carol I, a cousin of the German emperor, had died in October 1914, and had been replaced by his ineffectual nephew, Ferdinand I. A number of

leading Rumanian statesmen, including most of the Liberal Party leaders and Take Ionescu and Nicholas Filipescu of the Conservative Party, advocated joining the Allies, but the premier, Ion Brătianu, insisted on opportunistic caution and succeeded in resisting demands that Rumania act in concert with Italy. Throughout the first two years of the war, Brătianu held his ground. Ever more tempting blandishments were laid before him by the representatives of the Central Powers and the Allies, but not until the summer of 1916 did he weaken. By that time the Allies were offering to double the territory of prewar Rumania by ceding to her Bucovina, Transylvania, the Banat of Temesvár, Maramureș, and Crișana. Moreover, the Austrians had denuded the Hungarian frontier in order to mount an offensive against Italy, and this constituted an open invitation, as an Austrian statesman later wrote, for "a Rumanian military promenade." Brătianu gave in and on Aug. 17, 1916, signed with the Allies the Treaty of Bucharest, under which Rumania was to receive all that they had previously offered in return for a prompt attack on Austria-Hungary. Despite a divided vote in his cabinet, Brătianu kept this pledge, and, on August 27, declared war.

**Greece.**—The Greek government also came close to joining the Allies in 1915, not because of the Italian intervention but because of the Turkish concessions to Bulgaria. The most popular public figure in the country, Eleutherios Venizelos, had been in favor of Greece's entering the war in 1914, but the king, Constantine I, and the royalist party had insisted successfully on a policy of neutrality. With evidence that Bulgaria was about to enter the war, however, Venizelos renewed his appeals, arguing that Greece should fulfill her 1913 treaty with Serbia, by the terms of which she was to send 150,000 troops to Serbia's aid if that nation were attacked by Bulgaria. In August 1915, the king reluctantly recalled Venizelos to the premiership and even more reluctantly accepted Venizelos' decision that, since Greece did not have the requisite 150,000 men, the Greek government should invite the Allies to send such a force through Greece to the aid of Serbia. The premier issued the invitation, and in October an Allied force landed at Salonika. When Venizelos stirred the National Assembly to a vote in favor of war with Bulgaria and Turkey, however, the king balked. He forced Venizelos to resign on October 5, and brought in first Alexandros Zaimes and then Stephanos Skoulouides as premiers who would preserve Greek neutrality.

Both the Central Powers and the Allies exerted continual and mounting pressure on the Greek government. Bulgaria seized a fortress on the Greek frontier. The French commander at Salonika, Gen. Maurice P. E. Sarrail, fomented anti-royalist agitation; and the French government eventually made a formal demand that the king hold new elections, presumably so that Venizelos' popularity could be proved. Then, after Rumania joined the Allies, Venizelos proclaimed an open revolt, set up a provisional government at Salonika, and on Nov. 25, 1916, issued a declaration of war against Germany and Bulgaria. Aided by French and British funds and naval support, he succeeded in establishing his sway over roughly half the country. In June 1917, Constantine agreed to abdicate and allow his young son, Alexander, to become king and Venizelos to resume office as premier. Venizelos immediately sent

Greek troops into battle alongside the Allies, and the governments of the Central Powers soon formally recognized a state of war with Greece.

**Plans for Partition of the Ottoman Empire.—Constantinople Agreement.**—During all this time the major Allies had been negotiating among themselves about the postwar distribution of the Ottoman dominions. The so-called Eastern question (q.v.) had occupied much of the attention of European diplomats for most of a century and a half, and contrivance had been piled on contrivance to keep the sultanate more or less intact. With Turkey's entry into the war on the German and Austrian side, however, statesmen in the Allied capitals concluded that the demolition of that empire was inevitable. The Russian government had traditionally sought free egress for Russian shipping from the Black Sea, and early in 1915 the czarist foreign minister, Sergei Sazonov, asked the British and French to agree in principle that after the war Russia should have control over the Turkish straits. Though British governments in the past had held to the conviction that Russia should be barred from the eastern Mediterranean, the London cabinet quickly agreed that this position would not be tenable after the war. Foreign Secretary Sir Edward Grey issued cautious statements to prepare public opinion for a reversal of the policy; then on March 12, 1915, he signed a secret convention with the Russian ambassador in London, according Russia the right to control Constantinople and the Turkish straits after the war, provided that "the aspirations of Great Britain and France in the Ottoman Empire as well as in other regions are realized." On April 12, the French foreign minister, Théophile Delcassé, signed a similar convention with the Russian ambassador in Paris. As we have seen, the secret Treaty of London, concluded in the same month, provided that Italy should have Antalya if the Ottoman dominions were divided among the Allies.

**Egypt.**—For the British and French, the chief problem was to draw up arrangements for the areas south of Turkey proper that were nominally under Ottoman control—the Levant, Mesopotamia, and the Arabian Peninsula. After Turkey's entry into the war, the Allies had been alarmed over the possibility of the sultan's arousing the Muslim world in a crusade against Christians. In part to prepare for such a contingency, in part to counter an expected Turkish offensive against the Suez Canal, the British government decided in November 1914 to end the fiction that their high commissioner in Cairo was merely an adviser to the Egyptian government, to proclaim a protectorate over Egypt, and to proceed to formal annexation of that land. Getting wind of this plan, the French protested that they should be entitled to do likewise in Morocco, but that Muslim unrest in that area made it impossible to do so, and that both allies should thus refrain from any immediate steps toward enlarging their empires. The British did go on to proclaim a protectorate over Egypt on Dec. 18, 1914, and to depose the pro-Turkish khedive, Abbas II Hilmi, but desisted from annexation.

**Nejd Treaty and McMahon Letters.**—Meanwhile, in the Ottoman dominions themselves British agents entered into separate and uncoordinated negotiations with Muslim leaders, endeavoring to detach them from the leadership of Sultan Mohammed V. The government of India sent first Capt. W. H. I. Shakespeare, the consul

at Kuwait, and then Sir Percy Cox, the resident in the Persian Gulf, to negotiate a treaty with Sheikh ibn-Saud. Signed on Dec. 26, 1915, this treaty recognized ibn-Saud as independent ruler of the Nejd and its dependencies, promised him defense, and granted him a subsidy in return for his friendly neutrality. The government of Egypt at the same time entered into correspondence with Husayn (Hussein), the sherif of Mecca. In a series of letters exchanged in 1915 and 1916, Sir Arthur Henry McMahon, the high commissioner in Cairo, promised Husayn "the independence of the Arabs" from the 37th parallel south, except for the coastal region "lying to the west of the districts of Damascus, Homs, Hama and Aleppo." In return, the sherif agreed to be advised exclusively by representatives of the British government and to give Britain administrative privileges in the vicinity of Baghdad and Basra. Vague though their language was, these letters obviously contradicted the assurance given to Husayn's rival, ibn-Saud, and when Husayn on June 5, 1916, proclaimed an Arab revolt against the Turks and on Oct. 29, 1916, declared himself king of the Arabs, the British cabinet had to announce with some embarrassment that it could only recognize him as king of the Hejaz.

**Sykes-Picot Agreement.**—By that time, furthermore, the whole situation had been complicated even further by an Anglo-French agreement which was consistent neither with the Nejd treaty nor with the McMahon-Husayn letters. After signing the straits agreements with Russia in March and April 1915, the two western European allies had commenced negotiations to define their "aspirations... in the Ottoman Empire." Sir Mark Sykes acted for Britain; Georges Picot, for France. By the spring of 1916 the two negotiators had arrived at an understanding, the Russian government had given its approval, and a formal Sykes-Picot agreement was signed on May 16. It provided that Russia should receive, in addition to the straits, the Armenian provinces of Turkey—Erzurum, Trebizond, Van, and Bitlis—and northern Kurdistan along the line Mus-Siirt-'Amadiya to the Persian border. France was to have Cilicia—that is, the area west of the Armenian provinces and south of the line Ala Dağ-Kayseri-Ak Dağ-Yildiz Dağ-Egin (now Kemalpaşa)—Kharput—and the Syrian coast inland to Damascus, Homs, Hama, and Aleppo and south to the area of Haifa. Britain was to have Haifa and Acre on the coast and all of southern Mesopotamia, including Baghdad, while the area between the British and French holdings was to be divided into a zone of French influence covering the Syrian hinterland to Mosul and a British zone from there southward. Alexandretta (now Iskenderun) was to become a free port, and Palestine was to be internationalized. Though the agreement made provision for one or more independent Arab states in the zones of influence, the terms did not accord with the pledges made either to Husayn or to ibn-Saud. Partly for this reason, the British and French endeavored to keep its provisions secret.

**St.-Jean-de-Maurienne Agreement.**—Italy nevertheless acquired a general knowledge of the Sykes-Picot understanding, and early in 1917 she asked for a supplementary accord with the other Allies in order to make more precise the vague clause about Turkish territory in the Treaty of London of 1915. On April 17, 1917, the premiers of Britain, France, and Italy signed an agreement providing that Italy should have the right to



annex most of the Vilayet of Konya, the sanjaks of Mentese (now Mugla), Antalya, and Icel, and the vilayet and city of Smyrna (now Izmir), and to have a sphere of influence north of Smyrna. But this agreement stipulated that the concurrence of Russia was required. Because of the revolution in Russia, that concurrence was never obtained, and the agreement remained inoperative. Aside from an informal understanding, reached by the British and French premiers in December 1918, that Britain should have Mosul in return for giving France a share in northern Mesopotamian oil, this St.-Jean-de-Maurienne agreement was the last inter-Allied compact to touch on the future of the Ottoman Empire.

#### THE NEUTRAL NATIONS

At the outset of the war international law affecting belligerent-neutral relations was vague. The London Naval Conference of 1908-1909 had produced the Declaration of London (q.v.), codifying rules for the protection of neutral commerce, but by 1914 it had not been ratified by any of the major belligerent states. The United States formally asked that all the warring nations abide by the declaration, and the British, French, Russians, Germans, and Austrians agreed to do so but reserved the right to modify its terms as conditions changed. The declaration included lists of items that were to be treated as contraband, absolute contraband, and noncontraband. When it accepted the declaration, the British government added a few new items to the contraband list, and nearly every month brought forth a new order in council extending the list still further. In February 1915, after the German government had confiscated stocks of food in Germany, food was in practice treated as absolute contraband; on Aug. 21, 1915, cotton was taken from the noncontraband category and added to the contraband list; and on July 7, 1916, the government announced that it was abandoning the declaration altogether. In nearly every instance the French and the Italians followed suit.

Meanwhile, the Allies were jointly exerting other pressures on neutrals that might trade with their enemies. They urged neutral governments to establish embargoes on commodities that might be militarily useful to the Central Powers; they rationed shipments to nations bordering Germany and Austria-Hungary so that those nations were able to import no more than they had before the war; they published blacklists of neutral firms that traded with the Central Powers, forbidding their own subjects to have dealings with such firms; and they denied to neutral shippers the right to buy coal in Allied ports except on the condition of signing bunkering agreements, or pledges not to trade with or carry goods for the enemy. In addition, beginning in March 1915, they established an undeclared blockade. Though for technical reasons avoiding use of the term "blockade," the British government on March 1 announced that it would endeavor to seize all "ships carrying goods of presumed enemy destination, ownership, or origin," and the French and Italian governments soon did likewise. The Allies thus made every effort to stop all flow of goods into and out of the territory of the Central Powers.

Owing to their geographical situation and their relatively limited naval capabilities, the Central Powers could not retaliate in kind. They pressed Continental neutrals to curtail trade with

the Allies, but they were able to strike at the seaborne commerce of Britain, France, Italy, and Russia only by employing novel devices and methods. In November 1914, the Allies had sown mines in the North Sea in order to prevent the German High Seas Fleet from sailing forth, and they had given notice that neutral vessels would enter this "mine war zone" at their peril. In the meantime, the Germans had discovered that submarines could elude the Allied naval patrols and operate even off the mouth of the Thames River. Exploiting the precedent set by the mine war-zone decrees, therefore, the German government announced on Feb. 4, 1915, that, effective February 18, it would consider all the waters around Great Britain and Ireland as constituting a "war zone," that in this zone its submarines would endeavor to sink all Allied shipping, and that submarine commanders could not guarantee the safety of neutral vessels. Subsequently, the German government gave assurances that it would do its best to prevent injury to neutral interests, and in practice submarines generally refrained from attacks even on Allied vessels if they seemed likely to be carrying neutral passengers. Not until Jan. 31, 1917, did the German authorities proclaim unrestricted submarine warfare. Thereafter, however, submarines sank Allied and neutral ships indiscriminately.

**Netherlands.**—At the outbreak of the war the Dutch mobilized to defend their frontiers but also issued proclamations of neutrality. Though public opinion veered sharply toward the Allies as a result of the German invasion of Belgium and the alleged atrocities committed by German forces there, the government held to its course. After a time it became clear that the nation probably did not have to fear attack by the Germans, for Amsterdam was proving useful to them as a port of entry for goods from overseas. By the spring of 1916, the Dutch were more anxious over rumors that the Allies might invade their country in order to attack the rear of the German armies in France. To fend off threats from either side, the government kept the armed forces in a continual state of partial mobilization.

Meanwhile, both the Allied economic war and the German submarine campaign weighed heavily on the Dutch economy. To satisfy the demands of the Allies, the government formed on Nov. 23, 1914, the Netherlands Overseas Trust Company, an organization of Dutch importers who were allowed by the Allies to receive goods on their guarantee not to re-export them to Germany or use them to replace Dutch goods so exported. Even this trust found itself severely rationed, however, and throughout the war the nation's vital export-import trade was much curtailed. The government protested to London and Paris about rationing, blacklists, and bunkering agreements. It also protested against British interference with the mails, the mine war-zone decrees, and specific violations of Dutch territorial neutrality by Allied warships and aircraft. At the same time, it protested against similar violations of Dutch neutrality by the Germans and against the submarine campaign. The government complained in particular of the sinking of the *Katwyk* in April 1915, of the *Tubantia* and the *Palembang* in March 1916, and of four grain ships in February 1917. In some cases, Germany apologized and offered reparations, while in others it disclaimed responsibility or justified the sinkings. Finally the Netherlands government, with

Germany's assent, took over German shipping in the Netherlands East Indies to replace some of the lost tonnage. In March 1918, when the government acquiesced under protest to the seizure of all Dutch ships in American and Allied ports and accepted compensation for them, Germany declared this action unneutral and brought on a crisis by demanding the right to ship supplies through the Netherlands to Belgium. The Dutch achieved a compromise agreement with the Germans and thus managed to maintain their neutrality to the end of the war.

**Switzerland.**—Though the neutrality of Switzerland was guaranteed by international agreement, the Swiss government took care after the outbreak of the war to keep its armed forces at maximum strength. The German-speaking majority of the population was pro-German, while the French-speaking and Italian-speaking population was generally pro-Ally, but the government was determined to maintain neutrality at any cost. It established a press censorship intended to hold down partisanship, and when there occurred public demonstrations, such as an anti-German riot that took place at Lausanne early in 1916, it apologized immediately to the potentially offended nation. Though both sets of belligerents carried on espionage and similar activities from headquarters within the country, the government attempted to suppress them only when they involved Swiss citizens and thus jeopardized the nation's neutrality.

The official policy did not, of course, spare Switzerland the penalties imposed by the belligerents' economic warfare. Like the Dutch, the Swiss protested the undeclared Allied blockade and the German submarine campaign. Dependent on imports of coal from central Europe and imports of food from overseas, however, they had to make concessions to both sides. On Oct. 11, 1915, they created the Swiss Economic Surveillance Society, a foreign trade corporation similar to the Netherlands Overseas Trust Company, whose members promised the Allies that imported goods would not be passed on in any form to the Central Powers. In September 1916, the government negotiated an agreement with Germany by which cattle, cheese, and aluminum were to be exchanged for coal, iron, and steel; and in May 1918, it arranged with the Allies to receive food in exchange for timber. London, Paris, and Rome protested the Swiss-German compacts, while Berlin and Vienna protested any agreements between the Swiss and the Allies. As a result, imports into Switzerland became increasingly meager, and by the time the war ended the population was on very short rations. But the majority of the people remained firm to the end in adherence to their traditional neutrality.

**Denmark.**—In Denmark public opinion was anti-German. Nevertheless, the government proclaimed its neutrality and simply mobilized part of the army and strengthened frontier defenses. It formed two merchant guilds, which the Allies allowed to receive imports on a guarantee against re-export to Germany. In 1915 it agreed to dispose of meat in the prewar ratio, with half going to Great Britain, 14 percent to Germany, and the rest for home use; to divide butter evenly; and to give Britain five eighths and Germany three eighths of its fish.

**Norway.**—Norway was pro-British from the outset, and though the Allied blockade sometimes aroused resentment, public anger rose most often

against Germany on account of the losses of shipping and life caused by submarines. Some of the earlier losses were apologized and paid for. By 1916 Norwegian merchants were signing contracts against re-exporting articles allowed to pass by the Allies, and in October of that year the government forbade all submarines to enter Norwegian waters. By the summer of 1918, nevertheless, 789 ships had been sunk, with a loss of 1,008 lives, and 53 were missing with 704 on board. These statistics were partly offset by the fact that in 1917 Britain cut off Norway's supply of coal because of her export of pyrites to Germany, and only furnished it again on condition that Norwegian ships make trips to France as well as to Norway. In August 1916, the British government contracted for 85 percent of the Norwegian fish catch. (This contract was taken over by the Norwegian government in 1918.)

With less than 4 percent of its area under cultivation, Norway imported a large part of its necessary cereals. Government control of food and, ultimately, strict rationing were found necessary. In addition, whale oil was refined and used to make oleomargarine. A treaty with the United States of May 3, 1918, allowed Norway to import foodstuffs, coal, and farm machinery for home consumption only. In return, timber, wood pulp, fish, metals for munitions, and nitrates were to be shipped to France. While the bulk of Norwegian exports during the war went to the Allies, some were permitted to go to Germany.

**Sweden.**—Of all the Scandinavian countries, Sweden had shown the strongest German ties. Most members of the court, of army and business circles, of the universities, and of the Conservative Party were sympathetic to the Central Powers. For years fear of a Russian advance across Sweden and Norway to warm water and apprehension of Russian aggression in the Baltic had made Sweden look to Germany for protection. This attitude was carefully stimulated by Germany. A small but aggressive group known as Activists advocated intervention on the side of the seemingly victorious Central Powers, with the hope of securing the Aland Islands and Finland from Russia. The Socialists and Liberals were strongly for peace. The government, however, decided for neutrality, mobilized part of the army, and made common cause with Norway and Denmark in defending neutral rights. In January 1915, export of munitions was prohibited, and in November belligerent submarines were forbidden to enter Swedish waters except in cases of emergency. Apologies were secured for several violations of neutrality, as in 1915, when Russian ships destroyed a German warship inside the three-mile limit, and in 1916, when a German cruiser fired on a Swedish submarine. In July 1916, Sweden closed the exit from the Baltic through Swedish waters, but reopened it after a strong British protest. Perhaps by way of compensation, 10,000 horses were sold to Germany.

Swedish-Russian relations improved somewhat in the course of the war. Trade was brisk, and railroad connections, long delayed for strategic reasons, were made. Thousands of German and Russian invalided prisoners were exchanged through Sweden, and much relief work was done. A crisis was caused in 1916 when Russia fortified the Aland Islands, but it passed when Russia and Britain guaranteed that the fortifications would be removed after the war. The collapse of Russia

removed the fear of that power. Sweden was particularly interested in Finland, where an important minority is Swedish. Beyond assisting refugees to escape, however, it did not intervene. To preserve order, the Åland Islands were occupied on Feb. 19, 1918, but the Swedish forces were displaced by the Germans on March 2.

Sweden objected to British interference with imports and the mails, and by stopping British mail for Russia in January 1916 she became involved in a serious controversy. An arrangement was finally made that reserved Sweden's right to claim damages. Until 1916 the Swedish government refused to permit merchants to make the usual contracts with the Allies concerning re-exports, and it finally agreed to do so only on condition that it supervise the working of the plan in Sweden. Both Britain and Germany wanted Swedish iron ore. By treaty, Sweden was bound to furnish a certain amount of ore to Germany, and the government refused to halt this export, but Britain acquired an increasing share of the Swedish output. Sweden continued to export timber for mine props to Britain despite the fact that Germany declared this material contraband and seized it whenever possible.

**Spain.**—Spain was more fortunate than the northern neutrals in being farther removed from actual fighting. Nevertheless, there was some danger of her being drawn into the war, particularly through the German submarine campaign. Spain had interests and sympathies with both sides of the conflict. In 1916 she gave assurances to France concerning the Pyrenees boundary and Morocco, and she withdrew some garrisons from the boundary of Portugal, then fighting as Britain's ally. On the other hand, trade with Germany increased, and a number of newspapers were suspected of receiving German money. The mass of the people seemed strongly in favor of neutrality. Liberals, Republicans, and Socialists, through their sympathies with radical and anticlerical France, were pro-Ally. Partly through dislike of French anticlericalism, church leaders, clericals, and Conservatives, together with most army officers, were pro-German. King Alfonso XIII appeared personally to favor the Allies, but he maintained a correctly neutral attitude, and his successive cabinets endeavored to curb violent outbreaks of sympathy for either side.

It was repeatedly charged that German submarines were obtaining supplies at unfrequented places along the coast, and though several damaged submarines were interned in Spain, some escaped, apparently with the connivance of local officials. Nevertheless, the German submarine campaign, especially after February 1917, inflicted heavy damage on Spain. By August 1918, one fifth of the Spanish tonnage had been sunk, much of it outside the area covered by German decrees and some of it even in Spanish home waters, with considerable loss of life. The Spanish cabinet finally announced that future losses would be made good temporarily by using equivalent German tonnage interned in Spanish ports. Germany would not at first agree to this plan. In October, however, preliminary steps were taken to put it into effect, but hostilities ended before much had been done.

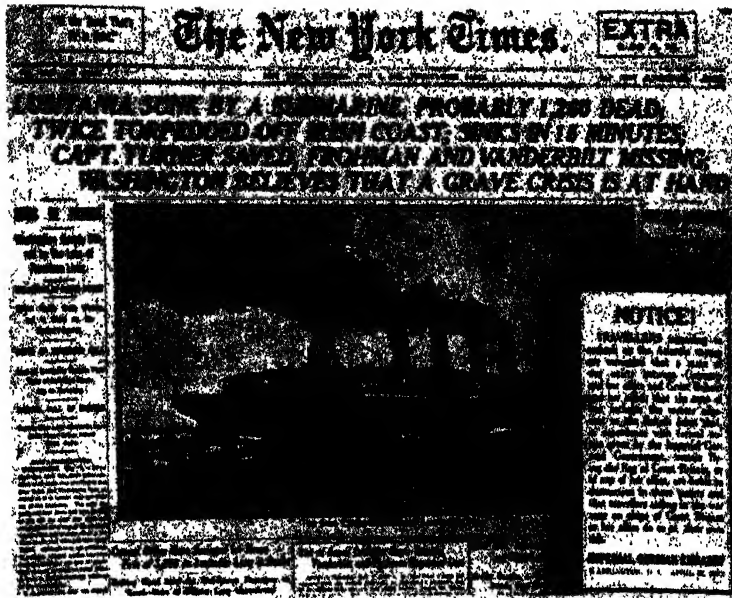
**United States.**—*Neutrality.*—From the outset of the war the United States faced formidable problems. As the world's greatest producer of foodstuffs, raw textiles, iron, steel, and petroleum, it carried on a large trade in peacetime with both

the Entente and the Central Powers, and its economic interests were certain to be affected by prolonged hostilities. Moreover, it had a large immigrant population with ties to the warring nations; there was an upsurge of pro-Ally feeling in the country from the moment that Germany invaded Belgium and Britain declared war; there was also an early surge of sympathy for the Central Powers among the large numbers of citizens of German and Austro-Hungarian descent and among Irish Americans, who were traditionally anti-British. On the other hand, President Woodrow Wilson and Secretary of State William Jennings Bryan were eager not only that the United States remain neutral, but that it set an example for other neutral states. In addition to proclaiming formal neutrality, therefore, the president called on the public to be "impartial in thought as well as in action."

*Friction with the Allies.*—Despite these efforts the government soon found itself drawn into controversies with the belligerents. The State Department asked all the warring states to abide by the unratified Declaration of London. The Central Powers agreed, but the Allies introduced modifications and additions, and the president and secretary of state became concerned lest the Allies not only interfere with American commerce, but also precipitate disputes over neutral rights, such as those which had led to Anglo-American war in 1812. The United States government made a determined effort to persuade the British to accept the Declaration of London *in toto*. When this effort failed, it fell back on a policy of simply protesting specific infringements of neutral rights as defined in traditional international law. Because of the amount of American trade with Europe, the result was a long series of protest notes, some of which attacked in vigorous terms British practices of visit and search, rationing, and additions to the contraband list.

*Submarine Issue.*—Controversy with Great Britain might have grown more acute had the Germans not issued their submarine war-zone decree in 1915. Wilson and his advisers found the German announcement shocking, for it seemed wholly to disregard the legal right of neutrals to trade with belligerents, and it threatened not only the property but also the lives of neutrals. As a practical matter, furthermore, it put in jeopardy America's growing ocean commerce and the nation's recovery from the recession of 1914-1915. On Feb. 10, 1915, therefore, the secretary of state directed to Berlin a very strong note protesting the decree and warning "that the Government of the United States would be constrained to hold the Imperial German Government to a strict accountability... and to take any steps it might be necessary to take to safeguard American lives and property and to secure to American citizens the full enjoyment of their acknowledged rights on the high seas."

Although Germany modified its original threat and offered vague assurances for the safety of neutrals, Wilson remained wary. When the Allies proclaimed their *de facto* blockade in March 1915, Secretary Bryan wished to protest, but Wilson insisted on waiting until the issues raised by Germany were settled. When an American citizen was killed in the torpedoing of the British vessel *Falaba* (March 28), and when an American tanker, the *Gulflight*, was attacked (May 1), the president considered renewing his protest but decided to be patient.



News of sinking of *Lusitania* reaches New York. Inset shows German warning published six days before, on May 1, 1915.

The Bettmann Archive

**Lusitania Incident.**—On May 7, 1915, however, the giant British liner *Lusitania* (q.v.) was torpedoed in the Irish Sea; 1,198 passengers went down with the ship, and of these 128 were Americans. The American press denounced the action of the German submarine commander as an atrocity, and several leaders of American opinion saw the incident as a justification for war. Even Secretary Bryan, who was almost a pacifist, agreed that some new representations were necessary, and on May 13 a note was dispatched to Berlin calling on the German government to disavow the submarine commander, make reparation for the lives lost, and pledge that in future submarines would not be used against any passenger liners or merchantmen. When the German response proved unsatisfactory, the president ordered that a second note be sent. Bryan could not bring himself to approve it, even though it merely restated the demands in the first note. He resigned on June 8, the day before the note was dispatched, and was replaced by Robert Lansing. When the new German response, dispatched on July 8, proved unsatisfactory, a third *Lusitania* note went to Berlin on July 21. By that time, however, the president was satisfied that the Germans had in fact ceased submarine operations against passenger-carrying vessels and neutral merchantmen, and he elected to let the exchange of notes drag on inconclusively rather than be excessively punctilious and insist on formal compliance with his demands.

**Increasing Friction with the Central Powers.**—On Aug. 19, 1915, the British liner *Arabic* was sunk with American passengers on board. Though Lansing and others advised taking a strong stand and perhaps severing relations, Wilson chose to delay action in the hope that the German government would voluntarily apologize. Johann Heinrich von Bernstorff, the German ambassador in Washington, did in fact offer an apology, revealing at the same time that German submarine commanders had had orders ever since the *Lusitania* incident to avoid attacks on vessels that might be carrying passengers. Some corre-

spondence ensued before Oct. 5, 1915, when the German government disavowed the act, offered an indemnity, and promised that submarine commanders would, at least for the time being, have orders to follow the traditional rules of international law. Though the submarine issue was less pressing as a result, German-American relations did not become much easier, for the year 1915 and the winter of 1915–1916 brought to light much evidence of espionage and sabotage committed by or financed by German and Austrian agents. This evidence caused the president to ask the recall of the German military and naval attachés, Capt. Franz von Papen and Capt. Carl von Boy-Ed; the Austrian ambassador and consul general in New York, Constantin Dumba and Franz von Nuber; and a German financial agent, Dr. Heinrich Albert, as well as to indict and bring to trial alleged German and Austrian agents.

**Wilson's Early Peace Moves.**—Despite the *Arabic* settlement, therefore, President Wilson grew increasingly uneasy about the prospects for avoiding conflict with the Central Powers. Though having been in the past an opponent of military preparedness, he changed his mind and in the winter of 1915–1916 became an advocate of limited measures to strengthen the Army and Navy. At the same time, he gave serious thought to promoting a negotiated peace in Europe and thus ending the danger to America's peace. At the very beginning of the war he had tendered his good offices to the belligerents, and he had subsequently explored the possibilities of mediation. By the end of 1915, however, he had come to consider the restoration of peace as not only morally desirable but as important for the interests of his country. Consequently, he approved an extraordinary proposal made to him by his closest friend and unofficial adviser, Col. Edward M. House, and sent House to Europe early in 1916 to seek a secret agreement with the Allies. House was to reach a general accord with the Allies about terms for peace. Then, when the Allied governments gave the signal, the president would issue an open appeal for peace negotiations. The Allies

would accept this appeal. If the Central Powers refused to negotiate or entered into negotiations and refused to accept the terms previously agreed upon by the United States and the Allies, the United States government would join the Allies in the war. House actually arranged a pact along these lines; he and Foreign Secretary Grey initiated a memorandum of agreement on Feb. 22, 1916. Wilson approved it, adding only the word "probably" before "leave the Conference as a belligerent on the side of the Allies, if Germany was unreasonable." But the Allies, perhaps because they interpreted this amendment as meaning that the United States would not carry out its part of the bargain, failed to invite Wilson to issue his appeal, and the agreement came to nothing.

**Gore-McLemore Resolutions and Sussex Crisis.**—Meanwhile, the president had to weather a domestic crisis. In the correspondence over the submarine issue, the German government had made the point that its undersea craft were at a disadvantage in adhering to the traditional rules of visit and search, for the Allies had fitted a number of merchantmen with large-caliber guns and had given merchant captains instructions to shoot on sight any German or Austrian submarine. Recognizing the force of this contention, Wilson and Lansing asked the Allies if they would not agree to a *modus vivendi*: they would agree to strip the armament from merchant vessels, and the Germans in return would promise that no ship would be sunk without inspection of cargo and provision for the safety of passengers and crew. When the Allies flatly refused, the Americans felt they had no choice but to revert to the position they had taken earlier and to insist that, despite the armament on some Allied vessels, German submarines should be bound by traditional law. News of the proposed *modus vivendi* had, however, leaked into the press, and a number of members of Congress took the view that its rejection entitled the United States to retreat from its position as a defender of neutral rights. Senator Thomas P. Gore of Oklahoma and Representative Jeff: McLemore of Texas, among others, introduced in the Senate and House resolutions which would have forbidden American citizens to take passage on belligerent vessels. The president opposed these resolutions. On Feb. 24, 1916, in an open letter to William J. Stone, chairman of the Senate Foreign Relations Committee, he declared:

For my own part, I cannot consent to any abridgment of the rights of American citizens in any respect. The honor of self-respect of the nation is involved. . . . To forbid our people to exercise their rights for fear we might be called upon to vindicate them would be a deep humiliation indeed. . . . It would be a deliberate abdication of our hitherto proud position as spokesmen even amidst the turmoil of war for the law and the right. . . . What we are contending for in this matter is of the very essence of the things that have made America a sovereign nation. She cannot yield them without conceding her own impotency as a nation, and making virtual surrender of her independent position among the nations of the world.

With this eloquent appeal and by means of various maneuvers, Wilson rallied a bipartisan coalition which decisively defeated the Gore-McLemore resolutions, but the episode had demonstrated that a substantial minority of public opinion was out of sympathy with the administration's policy on the submarine issue.

Scarcely had this demonstration been made than a new international crisis broke out. On March 24, 1916, the British channel steamer

*Sussex* was torpedoed, reportedly with casualties among Americans on board. Though Secretary Lansing and Colonel House urged the president to act immediately and forcefully, he chose to wait. Then, on April 18, he addressed to Berlin a note declaring, "Unless the Imperial Government should now immediately declare and effect an abandonment of its present methods of submarine warfare against passenger and freight-carrying vessels, the Government of the United States can have no choice but to sever diplomatic relations with the German Empire altogether." On May 4, the German government replied that it was ordering submarine commanders for the time being to suspend all operations against merchant shipping. The United States had thus succeeded once again in achieving a diplomatic victory.

**Renewed Friction with the Allies.**—While negotiating with the Germans about submarine warfare, Wilson endeavored to avoid controversy with the Allies. He had rejected Bryan's pleas for a protest against the *de facto* blockade of March 1915, and despite outcries from injured growers and exporters he also declined to protest the British order in council of August 1915, adding cotton to the contraband list. Instead, he allowed House to negotiate an agreement under which the British government purchased cotton to stabilize its price. Only on Oct. 21, 1915, after the settlement of the *Arabic* case, did the Department of State file in London a note complaining that the undeclared blockade constituted a departure from traditional international law, and partly because of the continuing uneasiness in German-American relations, this note was relatively mild. After the *Sussex* settlement, however, the president displayed more concern about Allied infringements of neutral rights. Irritated by the failure of the British and French to act upon the House-Grey memorandum of February, he had begun to doubt his original conviction that their attitudes and aims were morally superior to those of the Germans. At his direction, consequently, the Department of State dispatched to London a series of increasingly sharp notes protesting the blacklist, bunkering agreements, and other measures of economic warfare. On Sept. 7, 1916, the president obtained from Congress legislation permitting him to ban imports and deny clearance to ships, and he let the British government know that he might make use of these powers to retaliate against the Allies if they did not modify their course.

**Wilson's Final Peace Efforts.**—The position of the United States government was difficult by the closing months of 1916. The Allies showed no sign of making concessions to the American demands, and there was danger that friction with them would become increasingly acute. There was even greater danger of a new crisis with Germany, for reports from Berlin told of mounting demands in military and naval circles and in the Reichstag for unrestricted submarine warfare. But the presidential election campaign of 1916, in which Wilson had succeeded in achieving reelection, had shown beyond doubt that much of the public wanted the nation to remain uninvolved in the European conflict. Many observers believed, indeed, that Wilson had won because his supporters used the slogan "He Kept Us Out of War." There was thus a real possibility that the president might be forced to retreat from the positions he had taken in defense of international



w and neutral rights and to yield the very things at in his letter to Chairman Stone he had said America could not yield "without conceding her an impotency as a nation, and making virtual surrender of her independent position among the nations of the world."

In these circumstances, Wilson turned again to the hope that negotiations might restore peace in Europe before a crisis arrived in United States relations with either the Allies or the Central Powers. With the help of his advisers, he drafted a note to the belligerent governments, asking them to inform him confidentially of the terms of peace which they would accept so that he might investigate possibilities for a settlement of the war. Before the president had decided to dispatch this note, Chancellor von Bethmann-Hollweg called publicly on Dec. 12, 1916, for peace negotiations, perhaps believing that the restoration of peace was the only means of avoiding a decision for unrestricted submarine warfare, perhaps hoping thereby to make such a decision less unacceptable in American eyes, or perhaps simply concerned that Austro-Hungarian morale was crumbling and that the new Austrian emperor, Charles I, might seek a separate peace. Though the Allies declined this German invitation, Wilson nevertheless elected on December 18 to send his peace note to all the warring governments. As it turned out, the Central Powers replied brusquely on December 26 that any discussion of terms should be among the belligerents, and that they would reserve any statement until such discussions began, while the Allies responded on Jan. 10, 1917, with a statement of relatively mild terms. Hoping to induce the Germans and Austrians to change their minds, the president on Jan. 22, 1917, delivered an address to the Senate calling on both sides to accept "a peace without victory."

**End of American Neutrality.**—The German government gave an unencouraging answer to Wilson's appeal. On January 31, moreover, it suddenly announced that beginning the next day submarines would attack any and all vessels in the earlier-defined war zone. The decision in favor of this decree had been made by the German government in a crown council held at Schloss Pless on Jan. 7, 1917; the military and naval authorities had united in demanding it; and the Reichstag, in a resolution of Oct. 11, 1916, had declared that it would abide by the decision of Field Marshal Paul von Hindenburg and Gen. Erich F. W. Ludendorff, and these two officers advocated it. The chancellor and his civilian supporters had been unable to hold out, even though they felt certain that the decision was tantamount to a declaration of war against the United States. Wilson, in view of his earlier pronouncements, had no choice except to sever diplomatic relations, and he did so on Feb. 3, 1917.

In succeeding weeks the president waited in hope that the German government would back down, as it had in the past, but he was disappointed. The British liner *Laconia*, with Americans on board, was torpedoed on February 25, and several American vessels also were sunk. In addition, the British government communicated a copy of an intercepted message of January 19 from the German foreign minister, Arthur Zimmermann, to the German minister in Mexico, proposing a German-Mexican-Japanese alliance against the United States. The sinkings and the Zimmermann telegram, which was made pub-

lic on March 1, aroused violent feelings among the American public, and the pacifist element, led by former Secretary of State Bryan, appeared a shrinking minority. In late February, when the president asked Congress for authority to arm American merchantmen, action was blocked by a small minority, whom Wilson assailed as "a little group of willful men, representing no opinion but their own," but large majorities in both houses indicated that they would have approved if given the chance to vote. Within six to eight weeks after the publication of the German decree, the president had reluctantly concluded that the United States could not remain neutral, and that it had no choice except to intervene in the war. Consequently, he went before Congress on April 2, 1917, and asked for a declaration of war, saying that the nation would fight "for the ultimate peace of the world and for the liberation of its peoples, the German peoples included: for the rights of nations great and small and the privilege of men everywhere to choose their way of life and of obedience. The world must be made safe for democracy." The Senate approved the declaration of war on April 4 by a vote of 82 to 6; the House, on April 6 by a vote of 373 to 50.

See also UNITED STATES—18. *The Age of Industrial Growth, 1877–1919* (Wilson and World Affairs).

**Latin America.**—The vicissitudes of the American republics as neutrals resembled those of the United States. All Latin American governments issued proclamations of neutrality soon after the outbreak of the war, and all put in force much the same stringent rules as those adopted in Washington. Each state had to contend, however, with the violent partisanship of pro-Ally and pro-German elements in public opinion. Owing partly to economic and cultural ties with Britain and France, the pro-Ally factions were in most places predominant; only in Argentina and Chile did large numbers of intellectuals and army officers sympathize with Germany.

Each state encountered difficulty in maintaining its neutrality. Colombia, for example, became engaged in lengthy correspondence with the British government because of the operation of a German radio transmitter at Cartagena, and the issue was resolved only by the closing of the station in December 1914. Chile felt itself obliged to protest to the German government because of violations of its neutrality by German commerce raiders operating in the southern Pacific, for a German squadron on two occasions in 1914 overstayed the lawful time limit and drew excessive quantities of coal and supplies from harbors in Chilean-owned islands. This dispute was not settled until the Berlin authorities finally apologized in July 1916. Each state also found its relations with the belligerents irritated because of interference with neutral trade. Most Latin American governments protested or complained of the Allied blacklists, bunkering agreements, and import restrictions. Though none joined the United States in protesting the German submarine decrees of 1915 and 1916, all those with merchant shipping warned the German government that they would not disregard injuries to their vessels or citizens.

The breach between the United States and the Central Powers required nearly all the Latin American republics to re-examine their policies. President Wilson suggested that all of them

should imitate his action. In Cuba and Panama, where American influence was strong, the governments acquiesced promptly; both declared war on April 7, 1917. Bolivia endorsed the American position on the submarine issue and then, on April 13, 1917, severed relations with Germany on the ground that Bolivian citizens had been endangered by the sinking of the Dutch ship *Tubantia* in March 1916. Guatemala took the same action on April 27, 1917, because of Germany's failure to reply to its note of protest against submarine warfare. Honduras on May 17, 1917, and Nicaragua on May 19, 1917, severed relations with Germany, and both followed eventually with declarations of war—the former on July 19, 1918, and the latter on May 8, 1918. Costa Rica, though its government was not recognized by that of the United States, offered the hospitality of its waters to the United States Navy; on Sept. 21, 1917, broke relations with Germany; and on May 23, 1918, declared war. Uruguay at first declared itself neutral in the American-German war, but in June 1917 it issued a decree invoking "the principle of American solidarity," and declaring that no American nation "which in defense of its own rights should find itself in a state of war with nations of other continents will be treated as a belligerent." The Uruguayan government then opened its ports to American warships. On Oct. 7, 1917, it proceeded to break off relations with Germany, but despite submarine incidents involving Uruguayan citizens it did not go on to a declaration of war.

Peru severed relations with Germany on Oct. 6, 1917, and Ecuador followed suit on Dec. 7, 1917, but both stopped short of declaring war. The Dominican Republic, occupied by the United States, had no legal existence at the time. Haiti, though also occupied, retained nominal sovereignty, and its National Assembly refused in May 1917 to issue a declaration of war. Subsequently, however, the assembly was dissolved and replaced by a Council of State, and this body complied with the wishes of the occupying power by declaring war unanimously on July 12, 1918. Paraguay proclaimed its sympathy for the United States but did nothing more. The Venezuelan government, after first refusing to state even moral approval of the American stand, shifted ground and on May 3, 1917, issued a proclamation like the Paraguayan. The Mexican government, which enjoyed an uneasy relationship with the United States, proposed in February 1917 that the American republics take common action to bring the war to an end. When this appeal was rejected, it simply lapsed into a strict neutrality, which it maintained throughout the war. El Salvador and Chile likewise remained neutral. Of the American republics, eight joined the Allies—Cuba, Panama, Guatemala, Nicaragua, Honduras, Haiti, Costa Rica, and Brazil; four broke off relations with Germany—Bolivia, Uruguay, Ecuador, and Peru; and seven maintained their neutrality—Paraguay, Venezuela, Mexico, El Salvador, Colombia, Chile, and Argentina.

**Brazil.**—Brazil, the greatest of the Latin American states, had the closest relations with the Allies. In addition to ties with Britain and France, it possessed historic links with Portugal, and it had a large Italian population, principally in São Paulo. Partly in consequence, its people reacted immediately to the outbreak of war; Brazil became the only neutral state to protest the German invasion of Belgium. Despite increasing irritation

in relations with the Allies, due mainly to British interference with the coffee trade and with Brazil's substantial merchant marine, public sympathy for the Allied cause showed no marked diminution. In February 1917, when the Brazilian government filed a protest against the 1916 sinking of the *Rio Branco*, there was public rejoicing. When the *Paraná* went down on April 4, 1917, with three Brazilian crewmen among the dead, mobs attacked German properties. After the *Tijuca* was sunk on May 20, the government responded by seizing interned German merchantmen, and on Oct. 26, 1917, after the *Macau* also had gone down, the Senate voted unanimously, and the Chamber of Deputies by 149 to 1, in favor of a declaration of war. Because of its own grievances and quite independently of the United States, Brazil thus became one of the Allied and Associated Powers.

**Argentina.**—The Argentine Republic, then second among the Latin American states, also followed an independent policy. Though its people appeared largely pro-Ally, it had a considerably larger pro-German faction than its Portuguese-speaking neighbor. At the outset of the war its government endeavored to establish a neutrality even stricter than that of the United States. It forbade its ports to armed merchant vessels on Aug. 17, 1914, and subsequently interned several vessels that disregarded this rule. On Dec. 8, 1914, it forbade any Argentine vessel to send radio messages without prior official clearance. In addition, it made representations to the British and German governments about interference with trade and submarine warfare. On April 10, 1917, President Hipólito Irigoyen issued a cautious statement of sympathy with the United States, and on April 21 his Foreign Ministry filed a strong protest in Berlin about the torpedoing of the *Monte Protegido*. The German government promised an indemnity for this vessel, however, and subsequently offered compensation for two other Argentine ships that were sunk.

Nevertheless, public opinion became increasingly anti-German, and in 1917 there were widespread demands for the severance of relations or even for a declaration of war. The pretext was the publication by the United States in September of intercepted correspondence from the German minister in Buenos Aires, Karl von Luxburg, in which the Argentine foreign minister was described as "a notorious ass and Anglophile," and the German government was counseled either to spare Argentine vessels or to make sure that they were sunk without trace [*spürlos versenkt*]. Both houses of the Argentine Congress voted in favor of breaking relations, but President Irigoyen refused to ratify their action and succeeded on September 23 in winning from the German government an apology and a disavowal of the minister's words. He then kept Argentina neutral until the end of the war.

**China.**—At the outbreak of war, China was still in turmoil following the revolution of 1911 and the overthrow of the Manchu dynasty in 1912. The president of the Chinese Republic, Gen. Yuan Shih-k'ai, envisioned a restoration of the monarchy with himself as the founder of a new dynasty, and in 1915 he approached the Allied governments with the suggestion that they grant recognition to such a monarchy in return for China's joining them in the war. The British, French, and Russian governments were not un-receptive, but the Japanese government vetoed

the project. Then, with the death of Yüan in June 1916, such national unity as had existed in China practically disappeared. The government and National Assembly in Peking ceased to exercise control much beyond the boundaries of the capital city, and actual rule lay with various war lords commanding separate districts and living in uneasy alliance with one another.

The officials in Peking hoped to restore central authority and saw intervention in the war as a means of doing so. When the United States severed relations with Germany in February 1917, they approached the American minister with a proposal that China follow suit in return for a \$10 million loan from the United States. The minister readily agreed, only to have his action disavowed by the Department of State, which had no wish to seem to be purchasing Chinese support. The Peking authorities then turned to the Allied governments, suggesting that China might join them if suitably compensated. The European cabinets were still interested, and by this time the Japanese government had not only reconciled itself to China's entering the war but had decided that Japan might reap positive benefits therefrom. The Foreign Office in Tokyo asked Britain, France, and Russia for assurances of support for postwar Japanese demands in Shantung and the North Pacific and, after receiving them, notified both the Allies and the Chinese of its willingness to have China as an ally.

On Feb. 24, 1917, a French ship, the *Athos*, had been torpedoed in the Mediterranean, with 543 Chinese coolies among the dead, and the Peking authorities on March 14 gave this incident as their reason for breaking off relations with Germany. Great dissension then arose over the issue of proceeding to a declaration of war. The National Assembly, on May 11, refused to vote such a declaration. Within a month the entire central government had been dissolved. Troops of the northern war lords entered Peking and installed a new cabinet, and on Aug. 14, 1917, this body declared war by proclamation. China thus became, at least in name, one of the Allies.

See also BLOCKADE—Practice in World Wars I and II; NEUTRALITY; SUBMARINE—5. *History of Submarine Warfare* (World War I).

#### TERMINATION OF THE WAR

**First Signs of Peace.**—From the onset of hostilities neutral governments, peace advocates in the neutral states, and pacifists in the belligerent nations had kept their eyes open for any opportunities to end the war. The United States Department of State had quietly explored such possibilities during Bryan's tenure as secretary, and Colonel House had traveled to Europe in 1915 and 1916 as President Wilson's unofficial emissary, investigating the attitudes of the warring governments with regard to peace terms and peace negotiations. Similar unofficial missions had been sent out in 1915 by the kings of Denmark and Sweden. In December of that year, a wholly nongovernmental effort was undertaken by a group headed by the American motor car manufacturer Henry Ford. Responding to appeals from such peace advocates as Jane Addams and Rosika Schwimmer, Ford chartered a ship, the *Oscar II*, sailed for Europe with a large number of pacifists, and announced that the group would sponsor a peace conference for the belligerents; the ship's radio broadcast the message "Out of the trenches by Christmas." But as none of the Scan-

dinavian states would serve as host for the proposed conference, Ford gave up and went home, and the sessions finally held at The Hague in January 1916 proved inconsequential. The same fate attended international conferences of Socialists, including a much publicized one scheduled to be held at Stockholm in the summer of 1917.

**Sixte Affair.**—By the end of 1916, more than one of the belligerent governments had begun to consider the possibility of suing for peace. The German chancellor's public appeal of December 12 had been prompted not only by considerations rising from the submarine controversy with the United States, but also by pressure from Austria-Hungary. The new head of the Dual Monarchy, Emperor Charles I, was concerned about the possibility of internal collapse, and, in addition to urging the Germans to propose general negotiations, he suggested to his mother-in-law, Archduchess Maria Antonia of Bourbon Parma, that an approach to the French government be made through the Bourbon princes serving in the Belgian Army. Arrangements were made, and in February 1917, Prince Sixte (Sixtus) of Bourbon met with a personal envoy of the emperor at Neuchâtel, Switzerland, to receive a statement of Austrian conditions for peace. In effect, the emperor proposed a restoration of the *status quo ante bellum*.

When Sixte reported verbally to the French government on the Austrian proposal, President Raymond Poincaré and Premier Aristide Briand proved receptive. In March, they sent Sixte back to Switzerland to meet again with the Austrian representative and suggest an armistice providing for immediate cessation of hostilities on the Austro-Hungarian fronts. The French asked only that Austria agree in principle that Alsace-Lorraine be returned to France by Germany, that Belgium be restored to independence and indemnified, that the Kingdom of Serbia be restored and given an outlet to the Adriatic through Albania, and that Russia have Constantinople. Sixte not only presented these terms to the Austrian envoy but proceeded to Vienna and laid them before the foreign minister and the emperor. The Austrian government agreed to take them under advisement and actually went on in later March and early April to discuss their substance with the German chancellor and William II, though without disclosing the fact that negotiations with France were in progress.

While the Austrians studied the Poincaré-Briand proposals, Briand ceased to be premier of France. His successor, Alexandre Ribot, was personally hostile to the Bourbon princes and had more confidence than Briand in the ultimate triumph of the Allies. Ribot insisted on discussing the Sixte negotiations with the British prime minister, David Lloyd George, and in conversations that took place at Folkestone on April 11, 1917, he pointed out a fact which Briand had elected to disregard. The territorial pledges given by the Allies to Italy and Rumania in the secret treaties of London and Bucharest were inconsistent with the terms that had been outlined for the Austrians. Lloyd George agreed that the gist of the Franco-Austrian negotiations had to be disclosed at least to the Italians. This was done during the meeting of the British, French, and Italian premiers at St.-Jean-de-Maurienne in April 1917, and the Italian proved obdurate in insisting on literal fulfillment of the Treaty of London. Thus, though Sixte visited Vienna again in May,

the project was for all practical purposes abandoned. Later talks in Switzerland between other Allied and Austrian representatives were similarly inconclusive.

**Reichstag Peace Resolution.**—The German government was meanwhile put under pressure not only by its weakening ally, but also by a growing body of domestic opinion favoring some negotiated settlement of the war. At the outset of hostilities the Social Democratic Party had only voted to support the government after considerable debate, and the majority of its leaders maintained the position that the nation should stop fighting whenever its enemies conceded that they could not triumph. They combated Pan-Germans and others, generally of the right-wing parties, who insisted that the country should annex Belgium, Poland, or other such territories; they were supported in this moderate stand by members of the Progressive Party and of the left wing of the Catholic Center Party; and these three groups together constituted a majority in the Reichstag. When Chancellor von Bethmann-Hollweg issued his peace appeal in December 1916, this majority enthusiastically supported him.

When this act was followed by the rejection of Wilson's peace note, the declaration of unrestricted submarine warfare, and war with the United States, the majority's leaders became concerned that their government was not pursuing peace with sufficient energy. Consequently, despite objections from the chancellor and the high command of the army, they brought before the Reichstag a resolution declaring: "Germany has taken up arms in defense of her freedom, her independence, and the integrity of her soil. The Reichstag strives for a peace of understanding and a lasting reconciliation among peoples. Violations of territory and political, economic, and financial persecutions are incompatible with such a peace." It was passed on July 19, 1917, by a vote of 212 to 126. But the new chancellor, Georg Michaelis, accepted it in a speech that interpreted away much of its meaning, and shortly afterward one of the Center Party leaders justified the resolution to a party caucus by citing a secret memorandum on the faltering morale of Austria-Hungary. Thus, like the peace appeal of December 1916, the Reichstag resolution came to seem a tactical expedient employed by a nation still bent on achieving victory.

**Papal Peace Effort.**—The Center Party's leaders had been prompted to support the peace resolution in part because they had had intimations that the Vatican was about to urge peace negotiations. Pope Benedict XV, installed shortly after the outbreak of war, had previously refrained from any action that might be interpreted as interference with the belligerents, or that might occasion criticism among anticlerical parties in France, Italy, and Austria or the Protestant and Orthodox majorities in Germany and Russia. By mid-1917, however, he had decided that the time had come for an effort to bring the warring governments together, and in June he sent Monsignor Eugenio Pacelli (later Pope Pius XII) to Germany to sound out opinion there. Pacelli reported that the chancellor held very moderate views, while the kaiser and the generals commanding the armies were noncommittal but not intransigent. Other envoys evidently sent in comparable reports with regard to the other belligerent governments; the Reichstag passed its peace resolution; and on Aug. 1, 1917, the pope addressed a public ap-

peal to all the belligerents to accept a peace of compromise, making mutual concessions with regard to territorial issues, otherwise restoring the *status quo ante bellum*, and establishing an international organization for arbitration.

Journalists and officials in the Allied countries generally viewed this papal note as having been inspired by Germany and, like the Reichstag resolution, as constituting either a trick or a sign of approaching collapse. None of the Allied governments except the American made a formal reply. President Wilson's answer of August 27 stressed the moral objections to negotiations with governments that had, in his view, initiated an aggressive war and pursued throughout a policy of aggrandizement and conquest. The British government did, however, return an informal and confidential reply suggesting that the Allies might be willing to enter into further discussions if they were assured that Germany would restore and indemnify Belgium and agree to terms that would make renewal of the war impossible.

The Vatican communicated this word to Berlin and waited hopefully for the response of the German government, but the leaders of the German Army and Navy, supported by the representatives of right-wing groups, remained insistent that the war leave Germany in complete or partial control of Belgium. After a conference on Sept. 11, 1917, among a number of the kaiser's highest officials, it was agreed that the reply to the pope should be moderate in tone but make no promise with regard to Belgium. When this reply was received at the Vatican, Benedict asked the German government to reconsider the possibility of offering a guarantee on Belgium, but the authorities in Berlin responded by making their previous answer public. This ended for the time being all chance of further negotiations.

**Collapse of the Eastern Front.**—Though Russia had been the first of the Allied powers to go to war, and the Russian government had agreed in the Pact of London to engage in no separate negotiations with the Central Powers, the possibility of Russia's making a separate peace had existed from the very beginning. A number of members of the Russian aristocracy remained pro-German, and at various times individuals from the Russian court circle had talked unofficially with representatives of the Central Powers about possible negotiations. Count Sergei Witte, who had often in the past been a spokesman for the nation's rising commercial and industrial groups, spoke in favor of Russian withdrawal from the war. So did leaders of the growing radical, socialist, and revolutionary parties.

The government that came into power after the Revolution of March 1917 was committed to continuing the war. It backed away from the policy of the czarist government only by proclaiming on April 9, 1917, that its aim was "not the forcible seizure of foreign territories, but the establishment of a stable peace on the basis of the self-determination of peoples." When the Bolsheviks seized power in November 1917, however, they went further; on November 8, the Congress of Soviets passed a resolution calling on all the warring powers for "an immediate peace without annexations . . . and without indemnities"; on November 21, the new commissar of foreign affairs, Leon Trotsky, formally asked the Allies to agree to negotiations on such a basis. The Allied governments refused even to receive the communication. Conferring later that month in Paris, the Allied

leaders agreed that they would not release Russia from its commitment under the Pact of London; they declared simply that the Allies "would proceed to a revision of war aims together with Russia, so soon as there shall be a government aware of its duties to the country and defending the interests of the country and not of the enemy."

**Peace of Brest-Litovsk.**—The Bolsheviks nevertheless sent representatives under flag of truce to propose to the German and Austrian military authorities an armistice and the prompt opening of negotiations for a general peace. Conversations opened on Dec. 3, 1917, in the fortress of the Polish town of Brest-Litovsk (now Brest). Though the Russian delegates endeavored at first to discuss only terms for a general armistice, they eventually agreed to talk of an armistice for the eastern front alone. On December 15, agreement was reached on a 28-day cessation of hostilities (from December 17), during which time terms for a final settlement were to be negotiated. On December 22, delegations representing the Bolshevik government and the Central Powers gathered at the same place. The German government had meanwhile concluded that it would insist at least on Russian abandonment of the Baltic provinces. (Hindenburg had declared at a crown council at Kreuznach on December 19, "I need them for the maneuvering of my left wing in the next war.") The Bolsheviks, however, called for the application of the principle of self-determination; and on December 28, the conference was adjourned temporarily so that the Russians could receive fresh instructions and make one last appeal to the western Allies to join the negotiations.

After the conferees reassembled in January 1918, the Ukrainian Rada proclaimed the independence of the Ukraine. A separate Ukrainian delegation appeared at Brest-Litovsk, and the Russians reluctantly agreed in accordance with their own principles, that it could negotiate for the Ukraine. Consequently, on February 9, the Central Powers signed with the Ukrainian delegates a treaty re-establishing peace and providing that the Ukraine should immediately supply Austria-Hungary and Germany with grain. The Austrians, desperately in need of food, agreed to cede to the new state the district of Chełm, to guarantee certain civil rights to the Ruthenian population in the rest of Galicia, and to create a separate crown land for the Ukrainians of eastern Galicia and Bucovina.

Negotiations between the Central Powers and the Bolsheviks had continued in the meantime. The leaders of the German delegation insisted in effect that all territory under the control of the German Army be renounced by Russia. Trotsky, now leading the Russian delegation, tried to oppose this demand. He also opposed the Ukrainian treaty. Pointing out that bolshevism was spreading in the Ukraine, he withdrew recognition from the Ukrainian government. The Germans refused either to accept his position or to retreat from their own. In consequence, on February 10, Trotsky resorted to the expedient of declaring that the Russian government, instead of signing an unjust treaty, would simply proclaim peace and demobilize its forces. Though at first taken aback by this extraordinary procedure, the German government on February 18 responded by terminating the armistice and dispatching troops toward Petrograd.

Disappointed in their hope that the Germans would be compelled to accept their action, the



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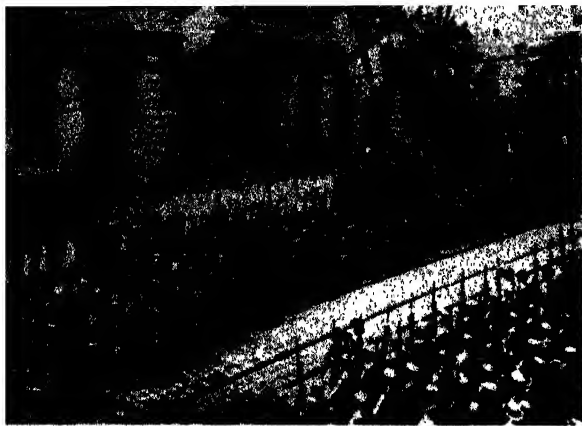
Left to right, Adolf A. Joffe, Lev B. Kamenev, and Leon Trotsky with Central Powers officers at Brest-Litovsk.

Bolshevik authorities appealed for a new armistice. The Germans demanded that they agree to withdraw all forces from the Baltic area and the Ukraine, halt all propaganda activity in central Europe, and immediately open commercial relations with the Central Powers. On February 24, the Russians agreed. Delegations met again at Brest-Litovsk, and on March 3, 1918, a treaty of peace was signed. Under its terms the Russians surrendered all claim to Courland (Kurland) and western Poland and to Kars, Ardahan, and Batum (now Batumi) on the Turkish frontier, and agreed to evacuate Finland, the Åland Islands, Estonia, and Livonia. The treaty was ratified by the Congress of Soviets on March 18 by a vote of 724 to 276 (with 204 abstentions). By a supplementary treaty signed at Berlin on August 27, the Russian government also renounced its claims to Estonia and Livonia. Though neither treaty provided for the actual annexation by Germany of the territories renounced by Russia, both were interpreted by Allied and neutral observers as providing proof of Germany's imperialistic war aims.

See also BREST LITOVSK, TREATIES OF.

**Allied Interventions in Russia.**—During the negotiations at Brest-Litovsk the Allied governments had continued to hope that Russia might somehow return to the war as an active belligerent. Many of the Allied representatives in Russia believed that an alliance with the Bolsheviks might be arranged. After the breakdown in negotiations and the resumption of hostilities by the Germans, the French, British, and United States governments offered sympathy and support to the Russians, but these offers were withdrawn when the armistice was renewed and the treaty signed. In the meantime the three governments had been debating what action might be taken to prevent stores of supplies in Russia from falling into German hands. In February 1918, it was decided for this purpose to land a small combined force at Murmansk, and with the consent of the local Bolshevik organization this was done in March. After the Soviet Congress' ratification of





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Japanese troops parade in Vladivostok, which was placed under four-power Allied control in July-August 1918.

the Treaty of Brest-Litovsk, the Allies proceeded to enlarge this force and to extend the area of its control. The Russian government protested on June 28, but on July 7 the Murman Regional Council proclaimed the area independent and invited the force to remain. The Allies willingly agreed. The British and French were already contemplating support for counterrevolutionary movements that might overthrow the Bolsheviks, repudiate the treaty; and put Russia back in the war. On Aug. 2, 1918, another combined force occupied Arkhangelsk, and when counterrevolutionaries proclaimed an independent republican government of the north, the Allied commanders at Murmansk and Arkhangelsk gave it quiet support.

Another proposal, which had been debated since early in 1918, called for a Japanese expedition to Siberia. The Japanese government indicated its willingness to take such action if requested by its allies, and military opinion in London and Paris was generally favorable, the British and French general staffs reasoning that an attack on Siberia would not only prevent the supplies stored in that region from being transferred to the enemy, but would also compel the Germans to retain a certain proportion of their forces on the eastern front. Before sanction could be given for a Japanese landing in Siberia, however, the consent of the United States had to be obtained, and President Wilson and his civil and military advisers were all opposed to the plan. In April 1918, when the British and Japanese put a small force ashore at Vladivostok in order to take possession of military supplies there, the United States government protested. The month of May, however, saw armed hostilities break out between the Bolsheviks and a Czechoslovak Legion that had been fighting with the Russians and, by agreement with the French, was being moved across Siberia to Vladivostok in order to be transported to the western front. On June 28, the legion, in company with certain Russian counterrevolutionaries, seized control of Vladivostok, and on July 17 President Wilson gave up opposition to a Siberian expedition, consented to Japanese landings, and agreed to send in American troops. A counter-revolutionary government was formed in Siberia under Adm. Alexander Kolchak, but the American commander, Maj. Gen. William S. Graves, refused to give it any support or encouragement.

**The Armistices.—Allied Declarations on Peace Terms.**—When the Bolsheviks came to power in Russia, they published the texts of the secret treaties which the Allies had concluded earlier in the war. Allied leaders felt it necessary to counteract any unfavorable impression and also to make public declarations that might reassure the Bolsheviks and encourage them to continue in the war. The first to speak out was the British prime minister. Addressing the Trades Union Congress at Caxton Hall on Jan. 5, 1918, Lloyd George declared that the Allies were not fighting a war of aggression against the German people, that the first aim of Britain was "the complete restoration, political, territorial, and economic, of the independence of Belgium and such reparation as can be made for the devastation of its towns and provinces"; the second was "the restoration of Serbia, Montenegro and the occupied parts of France, Italy and Rumania"; the third, the restoration of Alsace and Lorraine to France; and the fourth, an independent Poland. He concluded:

If, then, we are asked what we are fighting for, we reply, as we have often replied—we are fighting for a just and lasting peace—and we believe that, before permanent peace can be hoped for, three conditions must be fulfilled. First, the sanctity of treaties must be re-established; secondly, a territorial settlement must be securely based on the right of self-determination or the consent of the governed; and, lastly, we must seek by the creation of some international organization to limit the burden of armaments and diminish the probability of war.

Partly so that Lloyd George might not seem the spokesman for all the Allied and Associated Powers, partly because the United States was not a party to any of the secret engagements among the European Allies, and partly because he believed that his nation had a broader and more unselfish view of the needs of the future, President Wilson hastened to issue a statement of his own views. Addressing Congress on Jan. 8, 1918, he outlined "the only possible program" for peace in 14 points:

- (1) Open covenants of peace, openly arrived at. . .
- (2) Absolute freedom of navigation upon the seas, . . . alike in peace and war. . .
- (3) The removal, so far as possible, of all economic barriers and the establishment of an equality of trade conditions among all . . . nations. . .
- (4) Adequate guarantees given and taken that national armaments will be reduced to the lowest point consistent with domestic safety.
- (5) A free, open-minded, and absolutely impartial adjustment of all colonial claims, based upon a strict observance of the principle that in determining all such questions of sovereignty the interests of the populations concerned must have equal weight with the equitable claims of the government whose title is to be determined.
- (6) The evacuation of all Russian territory and such a settlement of all questions affecting Russia as will secure the best and freest cooperation of the other nations of the world in obtaining for her an unhampered and unembarrassed opportunity for the independent determination of her own political development and national policy and assure her of a sincere welcome into the society of free nations under institutions of her own choosing. . .
- (7) Belgium . . . must be evacuated and restored, without any attempt to limit the sovereignty which she enjoys in common with all other free nations. . .
- (8) All French territory should be freed and the invaded portions restored, and the wrong done to France by Prussia in 1871 in the matter of Alsace-Lorraine . . . should be righted. . .
- (9) A readjustment of the frontiers of Italy should be effected along clearly recognizable lines of nationality.
- (10) The peoples of Austria-Hungary, whose place among the nations we wish to see safeguarded and assured, should be accorded the freest opportunity of autonomous development.
- (11) Rumania, Serbia, and Montenegro should be evacuated; occupied territories restored; Serbia accorded free and secure access to the sea; and the relations of the several Balkan states to one another determined by

friendly counsel along historically established lines of allegiance and nationality; and international guarantees of the political and economic independence and territorial integrity of the several Balkan states should be entered into.

(12) The Turkish portions of the present Ottoman Empire should be assured a secure sovereignty, but the other nationalities which are now under Turkish rule should be assured an undoubted security of life and an absolutely unmolested opportunity of autonomous development, and the Dardanelles should be permanently opened as a free passage to the ships and commerce of all nations under international guarantees.

(13) An independent Polish state should be erected which should include the territories inhabited by indisputably Polish populations, which should be assured free and secure access to the sea, and whose political and economic independence and territorial integrity should be guaranteed by international covenant.

(14) A general association of nations must be formed under specific covenants for the purpose of affording mutual guarantees of political independence and territorial integrity to great and small states alike.

**Bulgarian Armistice.**—In June 1918, Radolav resigned as premier of Bulgaria and was replaced by Alexander Malinov, whose enthusiasm for war had always been lukewarm. Through its official press the Bulgarian government began at once to express an interest in negotiations for a separate peace. Meanwhile, morale in the Bulgarian Army was disintegrating, and resistance to continued fighting was evident in Sofia and in the countryside. Fearing revolution, King Ferdinand left for Austria, where he pleaded with his allies to give him reinforcements and to reaffirm their earlier promises with regard to the future enlargement of Bulgaria's frontiers. His appeals went unheeded, and, after long and anguished debate, a crown council in Sofia decided to send an armistice commission to treat with the advancing French force commanded by Gen. Louis Franchet d'Esperey. On Sept. 29, 1918, an armistice was signed at the general's headquarters (it was accepted the next day). By its terms, Bulgaria promised to evacuate all Allied territory; permit the occupation of portions of her own land by French, British, and Italian troops; grant the Allies free passage through Bulgarian territory; give them free control of the Danube River and of Bulgarian shipping on that waterway; demobilize the Bulgarian Army; and turn over to the Allies all rolling stock and other means of transportation.

**Turkish Armistice.**—With Bulgaria's surrender, Turkey was isolated; the Allies were pressing northward from Syria and Mesopotamia; elements of the Turkish Army were throwing down their arms; and bands of deserters, aggregating perhaps half a million men, were terrorizing the countryside. Shortly after the Bulgarian armistice, therefore, the government of Enver Pasha resigned and gave way to a nonpartisan cabinet headed by Ahmet Izzet Pasha. On Oct. 14, 1918, this new cabinet appealed for an armistice. Negotiators then met on the island of Lemnos, and on October 30 signed an armistice. Under its terms the Turks agreed to open the Dardanelles and facilitate the clearing of mine fields from the straits; surrender officers and garrisons in Tripolitania, Cyrenaica, Arabia, Syria, and Mesopotamia; withdraw all forces from northern Persia and Transcaucasia; permit the occupation by the Allies of strategic points in Turkey and, if necessary to prevent disorder, of the Armenian vilayets; give the Allies free use of Turkish merchant shipping; demobilize most of the army; and surrender the fleet.

**Austrian Collapse.**—*Beginnings of Disintegration.*—Within the Austro-Hungarian Empire con-

ditions had steadily deteriorated since the beginning of the war. Even before the accession of Emperor Charles I on Nov. 21, 1916, the government had begun urging Germany to seek peace, and in 1917 in the Sixte affair it had sought ineffectually to bring about negotiations with the Allies. Only the Bolshevik Revolution and the treaties with Russia and the Ukraine prevented starvation and probably internal collapse in the winter of 1917–1918. When the summer of 1918 came and Ludendorff's desperate offensives in the west failed, the Austrian ruler and his ministers concluded that they would have to seek peace even if it meant acting independently of Germany. If they did not, they feared, the empire would simply disintegrate, for the various nationalities of which it was composed were already threatening to break away.

A Czech committee had issued a declaration of war against the empire on Nov. 14, 1915; the Czechoslovak National Council, headed by Tomáš Garrigue Masaryk, had been formed in 1916; Czech units had deserted en masse to fight with the Allies; representatives of the Czechs and Slovaks had met in congress at Pittsburgh, Pa., in 1918 to proclaim the formation of a Czechoslovak state; this state had quickly been recognized by the Allies; and the Czech and Slovak delegates in the Austrian Reichsrat practically demanded that independence be accorded them.

Nationalism had manifested itself ever more strongly since the outbreak of war. In November 1916, the Austrian and German governments had sought to appease the Poles by declaring their support of a united, autonomous Poland and creating a 25-man Council of State to exercise some governing power within the region, but this council had dissolved itself in 1917 when confronted with the refusal of the two powers to allow the creation of an independent Polish Army. A Polish National Committee in Paris, led by Roman Dmowski, won recognition from the Allies, which, on June 3, 1918, made Polish independence a war aim. Poles in the Reichsrat indicated that they too might support this committee.

In the south numerous local councils of Croats and Slovenes had endorsed a declaration issued at Corfu on July 20, 1917, in which representatives of these two groups had joined with Serbs in calling for creation of a united south Slav (Yugoslav) state. Separatist sentiment was growing in Hungary, and numbers of German Austrians were calling for the dissolution of the empire and the creation of a separate Austrian state.

**Appeals for Peace.**—After having failed in renewed efforts to obtain German agreement for a joint peace effort, the Austrian government on Sept. 14, 1918, dispatched a note through neutral capitals to all the belligerent governments, inviting them to send delegates for a meeting in some neutral state where there could be "a confidential and noncommittal exchange of views." This appeal was rejected almost instantly by the United States and soon afterward by Britain and France. The convening of the Reichsrat on Oct. 1, 1918, showed the government that its condition was desperate. All the nationality groups, including the German, issued declarations in favor of independence. On October 4, therefore, the Austro-Hungarian government dispatched a note to the United States requesting an armistice and offering to make peace on the

basis of the Fourteen Points and subsequent declarations by President Wilson, but the United States Department of State replied on October 18 that the president could no longer agree to mere autonomy for the nationalities within the empire.

*Fragmentation of the Empire.*—While officials in Vienna awaited this response and then anxiously meditated their reply to it, the Austro-Hungarian Empire fell apart. At Agram (now Zagreb) on Oct. 19, 1918, an assembly of Croats, Slovenes, and Serbs asserted its sovereignty over the south Slav portions of the Dual Monarchy, and most of the districts south of the Drava River accepted this decree. In Warsaw, on October 7, a three-man Regency Council, which had been installed late in 1917 as the successor to the disbanded Council of State, proclaimed Poland an independent state; on October 15, the Polish deputies in the Reichsrat declared themselves "subjects and citizens of the free and united Polish State"; and by October 31, the Austrian garrisons had been ousted from Polish Galicia. On October 16, Emperor Charles had made a last effort to regain the loyalty of these groups by offering to transform the monarchy into a federation of self-governing nations, but the Yugoslavs and the Poles rejected the proposal. From the United States, Masaryk proclaimed the independence of Czechoslovakia, and the Czechs in Prague held a bloodless revolution on October 28 and removed all officials of the old empire. A Hungarian National Council, which had taken office in Budapest on October 25, appealed to the emperor to release them from their vows of fealty, and he regretfully did so on November 1. Meanwhile, the German Austrian members of the Reichsrat had resolved in favor of independence for German Austria, and assemblies in Bucovina had announced the secession of that region and its adhesion to Rumania.

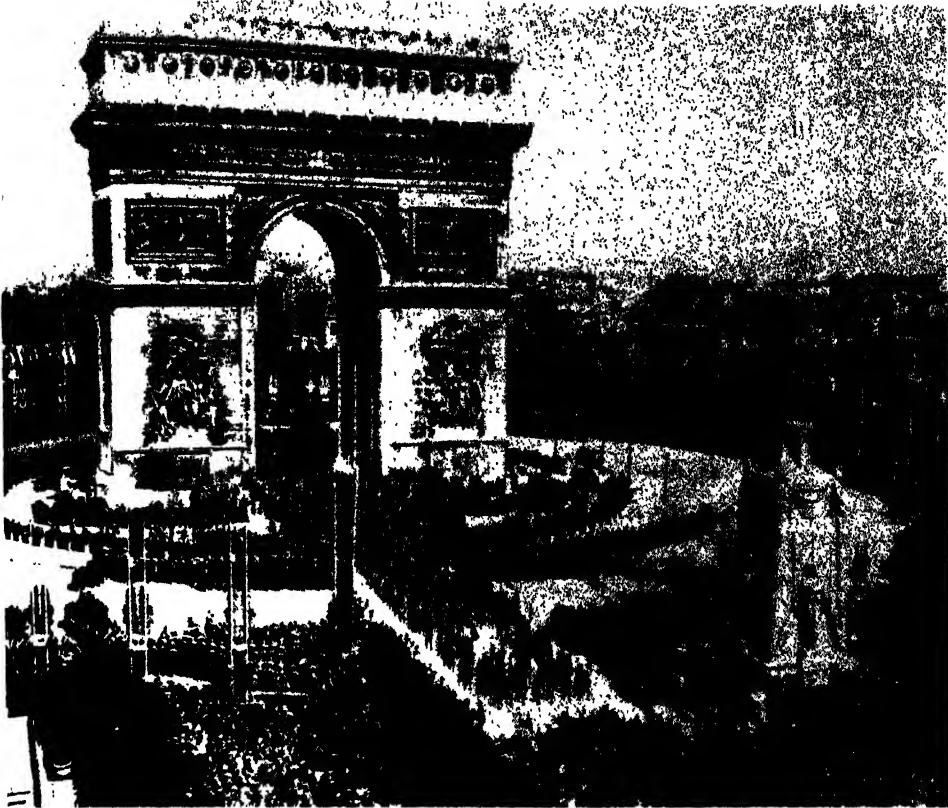
*The Armistice.*—Confronted with these dismaying events, the emperor and his officials abandoned all hope of negotiating for peace. On October 27, they offered to accept an armistice on almost any terms, and on November 3, at the Villa Giusti near Padua, their delegates signed an armistice providing for the immediate cessation of hostilities; demobilization of all Austro-Hungarian forces; evacuation of the Tirol, the Dalmatian coast, and the territory claimed by the Yugoslavs; surrender of all railway equipment and most of the fleet; and a grant to the Allies of power to move freely through the empire, occupy any part of it, and requisition supplies for their troops.

*German Armistice.*—In August 1918, when the Allied armies assumed the offensive in the west, the German High Command concluded that all hope of victory had disappeared. The state of morale on the home front had been revealed by the Reichstag peace resolution of July 1917 and, despite the termination of fighting in the east, by a wave of strikes in munitions plants in January 1918. Under the pressure of the Allied advance the morale of troops in the field began to crack. Consequently, in a conference held at Spa on September 29, General Ludendorff asked the civil officials of the government to arrange an armistice "without delay." By that time the Austrian government had issued its first appeal for peace, Bulgaria had sued for terms, and members of the Reichstag were calling for extensive changes in the German cabinet.

*First Exchange of Notes.*—Chancellor Georg von Hertling, who had succeeded Michaelis on Nov. 1, 1917, resigned almost as soon as the high command made its demand. His successor, Prince Max of Baden, was ordered by the kaiser to comply with the generals' wishes, and on Oct. 4, 1918, he dispatched through neutral channels a message to President Wilson, asking him "to take in hand the restoration of peace," and declaring that the German government accepted "as a basis for the peace negotiations" the Fourteen Points and others of Wilson's pronouncements. The American public, through its newspapers and spokesmen in Congress, greeted this message hostilely and called for "unconditional surrender," however, and the Allies advised Wilson that its aim was merely to divide Germany's enemies. Though Wilson decided not to dismiss it, as he had the Austrian appeal of September 14, he responded to it coolly, asking in a message of October 8 whether the German government would agree that his points and principles were to be the bases of peace so that negotiations would merely concern their application and, secondly, "whether the Imperial Chancellor is speaking merely for the constituted authorities of the Empire who have so far conducted the war."

*Second Exchange of Notes.*—This answer surprised the new chancellor. He was forming a cabinet representative of the majority parties in the Reichstag, and he had declared that it would be responsible to that body and not, as in the past, only to the kaiser. After conferring with military leaders and finding them little changed in their views, he and his advisers agreed that Wilson's questions should be answered in the affirmative. On October 12, therefore, the German Foreign Office replied that Germany "accepted the terms laid down by President Wilson in his address of January 8 and in his subsequent addresses as the foundations of a permanent peace of justice," and that the chancellor now spoke "in the name of the German Government and of the German people." This message, too, had a cold reception in the United States. Wilson, now under intense criticism both at home and abroad for entering into any negotiations at all, answered with four conditions: (1) the terms of the armistice were to be determined by the military advisers of the American and Allied governments; (2) no arrangement could be accepted "which does not provide absolutely satisfactory safeguards and guarantees of the maintenance of the present military supremacy of the armies of the United States and of the Allies in the field"; (3) submarine operations would have to cease immediately; and (4) the German government would have to show evidence that it had reformed its character.

*Third Exchange of Notes.*—This second American note was puzzling. The chancellor summoned a conference of the nation's principal civil and military officials to consider how it should be answered. He found to his astonishment that Ludendorff had changed his mind: the army could fight on, the general now said; an armistice on Wilson's terms was unnecessary and undesirable. The Admiralty opposed acquiescence to Wilson's third demand, but most of the civil ministers contended that the public desire for peace was so great and the state of civilian morale so low that the government could not break off negotiations. Endeavoring to effect a compromise among these wholly divergent



The Bettmann Archive

Troops of the victorious Allies parade under the Arc de Triomphe in Paris on Bastille Day, July 14, 1919.

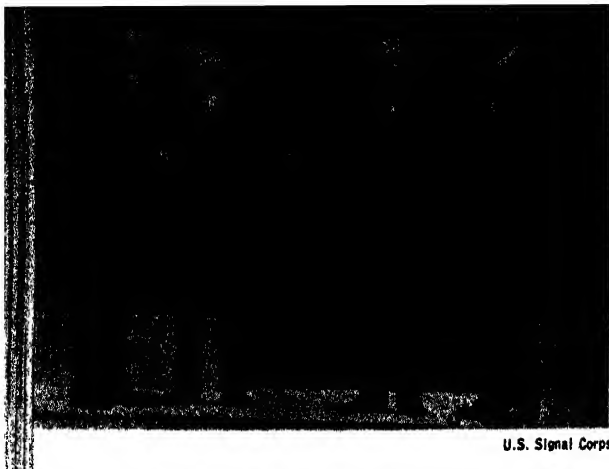
opinions, Max drafted and dispatched to Washington on October 20 a note agreeing that "the conditions of an armistice should be left to the judgment of the military advisers, and that the actual standard of power on both sides in the field has to form the basis for arrangements safeguarding and guaranteeing this standard"; stating that submarine commanders had been ordered to stop attacking passenger vessels; and asserting that the German government was "free from arbitrary and irresponsible influence," and was "supported by the approval of the overwhelming majority of the German people."

Wilson replied on October 23 that, in view of the concessions made by the Germans, he could not decline to take up with the Allies the question of a possible armistice. But he went on to declare "that the only armistice he would feel justified in submitting for consideration would be one which should leave the United States and the powers associated with her in a position to enforce any arrangements that may be entered into and to make a renewal of hostilities on the part of Germany impossible." He also asserted harshly that he remained unconvinced that the German government represented the German people, and that if the United States "must deal with the military masters and the monarchical autocrats of Germany now, or if it is likely to have to deal with them later . . . , it must demand, not peace negotiations, but surrender."

**German Collapse.**—On October 27, the German government replied with a simple reaffirma-

tion that "far-reaching changes" had been made and were being made in the constitutional system, and that it awaited "proposals for an armistice which shall lead toward that peace of justice the President had outlined in his proclamations." In the meantime, however, the fabric of German society had begun to split. Reichstag leaders and newspaper editors called openly for the kaiser's abdication, and Prince Max secured the dismissal of Ludendorff. On November 3, units of the fleet began to mutiny, winning support from dock workers in the port cities. By November 8, revolution had spread throughout the Rhineland. King Louis III of Bavaria abdicated, and workers, soldiers, and peasants moved to set up a Soviet-style government. Hamburg fell to left-wing Socialists, and agitators there endeavored to organize forces for a march on Berlin. In the capital itself, Social Democrats demanded the creation of a republic, and on November 9 the leaders of the army informed the kaiser that they could no longer guarantee his safety. Striving to stay the mobs that were already parading in the streets of Berlin, Prince Max announced that the kaiser and his heirs renounced the throne. Though William never agreed to this act, he finally reconciled himself to the counsels of prudence and, on November 10, fled to the Netherlands.

Meanwhile, on November 5, the government had received Wilson's fourth and last note, stating that the United States and the Allies were prepared to receive a German delegation and



The Council of Four—Lloyd George, Orlando, Clemenceau, and Wilson—at Wilson's house in Paris, May 27, 1919.

U.S. Signal Corps

communicate armistice terms to it. Max and his ministers selected Centrist leader Matthias Erzberger to head a four-man delegation, and it met on November 8 with Marshal Foch and other Allied officers in a railroad car on a siding at Compiègne. On November 9, the delegation accepted the terms offered them. Germany was to cease hostilities, and to evacuate France, Alsace-Lorraine, Belgium, and Luxembourg within 14 days from the signature of the armistice; the left bank of the Rhine and all territory on the right bank within a 30-kilometer radius of the principal crossings (Mainz, Coblenz, and Cologne) within 31 days; East Africa within an unspecified period; and lands previously belonging to Russia "as soon as the Allies, taking into account the internal situation of these territories, shall decide the time for this has come." Germany was also to surrender to the Allies a specified number of guns, airplanes, railroad cars, locomotives, trucks, and warships and all submarines. It was to renounce the treaties of Bucharest and Brest-Litovsk and agreements supplementary to them. In addition, it was to grant the Allies free access to its eastern regions and give them permission to requisition supplies for their forces, and it was to understand that the blockade would continue in force. Though protested by Hindenburg, these terms were accepted in Berlin, and early on the morning of November 11 the armistice agreement was signed by the delegations at Compiègne. The war was over at 11 A.M.

#### THE PEACE CONFERENCES AND PEACE TREATIES

**Organization and Proceedings of the Conferences.**—A conference among the victorious powers convened in Paris on Jan. 18, 1919. Each of the major belligerents (Britain, France, Italy, the United States, and Japan) was represented by a five-man delegation, assisted by varying numbers of experts and secretaries. The lesser belligerents had smaller delegations. All of these met periodically in plenary sessions of the conference, but the real power of decision was soon vested in a Supreme Council (Council of Ten) consisting of two representatives from each of the five great states, and later in a Council of Four, consisting of President Wilson, Prime Minister Lloyd George, Premier Georges Clemenceau of France, and Premier Vittorio Orlando of Italy. Numerous commissions were created to study special subjects, and these commissions

reported to the Supreme Council, which then approved recommendations to be put before the plenary sessions. The council also called in representatives of other belligerents, of neutral states, and of states in process of formation when questions affecting their interests were under discussion.

#### First Phase (Jan. 18–Feb. 14, 1919).

Through negotiations preceding the German armistice, President Wilson had won agreement from the Allies that the peace should be based on the points and principles which he had enunciated, the only exceptions being that "freedom of the seas" was to be left for later definition, and that Germany was to make compensation for the damage done to the civilian populations of the Allied states. His ideals had been hailed by spokesmen for public opinion in all the Allied nations. At the outset, at least, he was the dominant figure among the conferees, and he was able to insist that the first order of business should be the framing of a charter or Covenant for a League of Nations, and that this Covenant should be made an integral part of the treaties of peace. He himself took the chairmanship of the Commission on the League of Nations, which was to draft the Covenant and submit it to the conference, and he saw to it that no unrelated problem came to the point of decision before that work was finished.

**Colonial Mandates.**—It proved impossible, however, to frame the document without reaching some decision on the disposition of former German colonies, since Wilson took the position that, while these colonies could not be returned to Germany, they should not be treated as spoils of war, and their governance should be of primary concern to the proposed League. Representatives of Japan and the British Dominions opposed the president on this issue, for Japan desired the German Pacific islands north of the equator and the former German leasehold of Kiaochow in China, Australia wished to annex outright German New Guinea and the German islands south of the equator, and the Union of South Africa wanted similarly to take possession of German Southwest Africa. No meeting of minds seemed possible until Lt. Gen. Jan Christiaan Smuts of South Africa devised a compromise formula. He proposed that all the former German colonies be transferred to the League, but that the League assign a mandate for the governance of each one to some member state, and that these mandated territories be divided into three classifications: (A) those capable of eventual independence, in which the mandatory power would merely render "administrative advice and assistance"; (B) those, particularly in Central Africa, where the mandatory power would have to take responsibility for administration; and (C) "territories, such as Southwest Africa and certain of the South Pacific Islands, which, owing to the sparseness of their population, or their small size, or their remoteness from the centers of civilization, or their geographical contiguity to the territory of the Mandatory, and other circumstances, can best be administered under the laws of the Mandatory as integral portions of its territory." Though this last clause permitted virtual annexations by the Union of South Africa, Australia, and Japan, subject only to the requirement that they file an annual report with the League on conditions in the mandated territory, it proved acceptable to Wilson, who feared that the Dominions



and Japan might otherwise refuse to endorse the Covenant. Smuts' solution was approved.

#### See also MANDATES SYSTEM.

**Covenant of the League.**—No other serious problem arose during the first stage of negotiations. The French delegation did urge strongly that the projected international organization be equipped with a general staff and given additional power with which to enforce its decrees, but Wilson insisted that an organization which appeared to be a permanent military alliance would be unacceptable to the American public. The other members of the commission yielded to the president and eventually accepted a Covenant which closely resembled a draft that Wilson had initially put forward. It provided for an Assembly in which each member state, including self-governing Dominions and colonies, should have one vote; and a Council composed of representatives of the United States, Britain, France, Italy, and Japan, together with representatives of four other states, as chosen by the Assembly. The Council was to formulate plans for general disarmament and for the creation of a Permanent Court of International Justice; and, on reference from any member state, was to inquire into any situation threatening to cause a rupture between states, to report on the facts, and to make recommendations to the parties, the Assembly, or the member states. The agencies of the League, including a permanent Secretariat, were to register all treaties, and no treaty was to be binding unless it was so registered. They were also to exercise some control over traffic in arms and to endeavor to secure fair and humane conditions for labor.

The states joining the League were to promise that they would not resort to war with one another, and that, if a dispute proved insoluble by ordinary methods, they would submit it for arbitration or for investigation and recommendation by the Council. Most important of all, they were to pledge themselves to regard the security of any member as a matter of concern for all. Articles 10, 11, and 16 of the Covenant provided:

(10) The Members of the League undertake to respect and preserve as against external aggression the territorial integrity and existing political independence of all Members of the League. In case of any such aggression or in case of any threat or danger of such aggression the Council shall advise upon the means by which this obligation shall be fulfilled.

(11) Any war or threat of war, whether immediately affecting any of the Members of the League or not, is hereby declared a matter of concern to the whole League. . . .

(16) Should any Member of the League resort to war in disregard of its covenants. . . . it shall ipso facto be deemed to have committed an act of war against all other Members of the League. . . .

On Feb. 14, 1919, President Wilson presented the completed draft to a plenary session of the conference, declaring proudly, "a living thing is born." That evening he left for a short visit to his homeland.

**Second Phase (Feb. 15–June 28, 1919).**—**Amendments to the Covenant.**—In the United States, President Wilson discovered opposition to the Covenant already in flower. The opposition Republican Party had won control of both houses of Congress in the mid-term elections of 1918, and its leaders were critical of Wilson for having gone in person to Paris, for having included no conspicuous Republican or member of the Senate in the American delegation, and for having agreed to a Covenant that might conceivably allow League interference with American tariff

and immigration laws, abridge the Monroe Doctrine, or draw the United States into future European wars. On March 4, 1919, Senator Henry Cabot Lodge, the senior Republican on the Foreign Relations Committee, read into the *Congressional Record* a resolution declaring the Covenant "in the form now proposed" unacceptable. It was signed by 38 senators, or more than one third plus one which, under the United States Constitution, could prevent ratification of a treaty. By the time President Wilson returned to Paris on March 14, he and the other conferees knew that he would have to seek amendments to the original Covenant, and he quickly reconvened the Commission on the League of Nations and proposed new language that would specifically exclude tariff and immigration matters from the competence of the League, provide for a member state's voluntary withdrawal, and explicitly recognize the Monroe Doctrine.

In return for accepting these amendments, however, other delegations requested approval for other changes in the Covenant or asked for concessions by the president on economic or territorial issues. In the League of Nations Commission the French returned to their appeal for an international organization backed by permanent force. Although Wilson still could not yield to their view, he did give in to the extent of agreeing to sign with France and Britain a separate treaty of guaranty (June 28), under which the United States and Britain promised to come to France's aid if she suffered an unprovoked attack. (This treaty was never ratified in either Washington or London.) The Japanese asked that the president insert in the preamble to the Covenant phrases endorsing the principle of racial equality. Recognizing the difficulties that such phrases might cause in the British Dominions and in the United States, Wilson also had to refuse this demand. To mollify the Japanese and ensure that they accept the Covenant and join the League, however, he abandoned his opposition to their taking over the former German leasehold of Kiaochow as outright spoils of war, and contented himself with a promise that they would eventually return the territory to China. The French, the Japanese, and others then accepted his proposed amendments. The revised Covenant implicitly excluded tariff and immigration questions, provided that any state could withdraw from the League on two years' notice, and declared in a new Article 21: "Nothing in this Covenant shall be deemed to affect the validity of . . . regional understandings like the Monroe doctrine. . . ."

**Reparations Issue.**—While the League of Nations Commission resumed its sittings, the Council of Ten, succeeded by the Council of Four, turned to the framing of articles for the German peace treaty. One crucial issue which arose at once concerned the indemnities or reparations to be exacted from the vanquished. The French and British delegations obtained American acceptance of their view that the costs of the war should include such items as pensions to veterans and payments to the widows and children of the slain. The Commission on Reparations reported, however, that the resultant levies would far exceed anything that the defeated Germans could pay. The French took the position that the treaty should nevertheless contain such provisions. The British urged that the reparations be scaled down to a figure approxi-

inating expert calculations of the maximum that Germany could afford, while the Americans argued for reducing the figure still further in order to permit some degree of German recovery. Finally, the Council of Four agreed on a compromise. A Reparation Commission would subsequently fix the sums that Germany was to pay; the treaty of peace itself would merely compel the Germans to accept responsibility "for causing all the loss and damage to which the Allied and Associated Governments and their nationals have been subjected as a consequence of the war imposed upon them by the aggression of Germany and her allies." Included in the final treaty as Article 231, this was to become known as the war guilt clause, and to be the subject of many German polemics during the 1920's and 1930's.

*German Frontiers.*—The French urged not only that heavy economic burdens be laid on Germany, but also that she be weakened as much as possible by losses of territory. They advocated the creation in the east of a large and strong Poland—"grande et forte, très forte," in the words of the French foreign minister, Stéphen J. M. Pichon. The British and the Americans, though committed to the creation of an independent Poland, were fearful lest new frontiers in the east create irredentist movements that would be sources of trouble in the future. They argued, therefore, for boundary lines that would more or less follow discoverable lines of nationality. The compromises finally reached gave the province of Posen (Poznań) to Poland and created the Polish Corridor west of the Vistula River, giving the new nation access to the Gulf of Danzig. Danzig (Gdańsk) itself, largely German in population, was made a free city. Plebiscites were ordered for the districts of Marienwerder (Kwidzyna) and Allenstein (Olsztyn); held in 1920, they returned these areas to Germany. A plebiscite was also ordained for Upper Silesia. Held in 1921, it resulted in a partition; the eastern third went to Poland, while the less industrialized western parts reverted to Germany.

In the west the French wished to detach from Germany the left bank of the Rhine, creating an independent buffer state or a permanently occupied zone. The British and the Americans opposed these proposals, just as they opposed those which might cause irredentist movements in the east. After a prolonged dispute, during which Clemenceau once accused Wilson of being pro-German and Wilson summoned his official ship, threatening to break up the conference and go home, the Council of Four arrived at a set of compromises. France was given full title to Alsace-Lorraine and also to the coal mines of the Saar, which were expected to compensate her for wartime losses. The area itself was for a period of 15 years to be governed by the League of Nations and occupied by Allied forces. At the end of that time a plebiscite was to determine its final disposition. In addition, the southern part of the Rhine Province, Birkenfeld, the Rhenish (Bavarian) Palatinate, and Mainz and its environs were also to be occupied for 15 years. Another zone, including the central sector of the Rhine Province and Coblenz and its environs, was to be occupied for 10 years. The northern part of the province and the Cologne region were to be occupied for 5 years. On the right bank of the Rhine, Germany was forbidden to construct any fortifications or to maintain armed forces within 50 kilometers of the river, and the

whole Rhineland was to be permanently demilitarized.

*Fiume Issue.*—Premier Orlando of Italy insisted that before the German treaty was concluded the Big Four should reach agreement on certain questions not connected with that treaty which were of concern to Italy. Specifically, he desired a promise from Wilson and the Allies that the provisions of the secret Treaty of London of 1915 would be executed, and that in addition Italy would be given the city of Fiume, which had a large Italian population but which was surrounded by Yugoslav territory and was expected to serve the new state of Yugoslavia as its primary Adriatic port. The British and French, who were parties to the London treaty, took the position that they would either stand by that document, which did not assign Fiume to Italy, or consider it null and void, examine the Italian claim to Fiume, and also re-examine the Italian treaty claims to the Tirol, the Trieste region, and the islands of the Adriatic coast.

Wilson, who had not signed the London treaty, took the position that all decisions should be based on considerations of nationality, with due regard to the economic and strategic interests of both the Italians and the Yugoslavs. After studying the issue, he concluded that Fiume should remain with Yugoslavia. He had already retreated from many of the principles he had announced during the war: he had acquiesced in punitive territorial and economic clauses for the German treaty, and he had yielded Kiaochow to the Japanese. On the Fiume issue, however, he proved immovable, and on April 24, 1919, Orlando and his colleagues angrily left Paris. The final provisions of the German treaty were therefore composed by a council of three—Wilson, Clemenceau, and Lloyd George.

*The Peace Treaties.*—*Treaty of Versailles.*—The completed treaty, containing 440 articles and covering 200 pages of text, was approved by a plenary session of the conference on May 6, 1919. In addition to incorporating the Covenant of the League and the financial and territorial provisions which had resulted from the debates among the Council of Four, the final text also stipulated that after March 31, 1920, the German Army should not consist of more than 100,000 officers and men, and that the Allies should have the right to try Germans guilty of violations of the laws of war and to arraign the kaiser before a special international tribunal "for a supreme offence against international morality and the sanctity of treaties."

Wilson and the Allies had originally conceived of the Paris meetings as merely a preliminary conference, assuming that it would be followed by a full-scale conference with the Germans. Partly because of the time which the preliminary conference took, partly because of the increasing internal disorganization in Germany itself, this plan was at some point abandoned. The Paris conferees agreed instead simply to submit the draft to a German delegation and give the German government a period in which to return written observations on it. This was done on May 7; the German commentary was submitted on May 29; all changes proposed by the Germans were formally rejected; when the Germans still delayed signing, the Allies made preparations for renewed military action; and on June 23, the German authorities declared that they were compelled to yield before this threat of force. On

une 28, in the Hall of Mirrors at Versailles, a German delegation finally endorsed the document.

See also **VERSAILLES, TREATY OF.**

**Treaty of St.-Germain-en-Laye.**—A treaty for Austria had meanwhile been drafted, and an Austrian delegation had been summoned to Paris to receive it. The same procedure was followed (as indeed it was with the other defeated states—Bulgaria, Hungary, and Turkey): written comments were received and answered by the Allied and Associated Powers. The only difference was that certain minor concessions resulted from these exchanges. The final treaty did not arraign the former Austrian emperor as a criminal, although it did call on Austria to deliver war criminals for trial. It specified financial reparations and reparations in kind, and required Austria to demobilize her forces and renounce compulsory military training. It also forbade Austria to unite with Germany, and it provided for the surrender by the Austrian government of all claim to territories which were to be transferred to Italy, Rumania, and the new Yugoslav, Czechoslovak, and Polish states. Austria thus gave up all lands beyond the historic frontiers of Bohemia, Moravia, and Slovakia, all claim to Bucovina, and all lands south of the Karawanken (Karavanke) Mountains and the Mur River. The treaty did provide, however, for a new frontier with Hungary in which Burgenland remained with Austria, and it allowed for plebiscites in the regions of Klagenfurt and Teschen. (The former, held in October 1920, gave the area to Austria; the latter was not held, but in July 1920 the Conference of Ambassadors, successor to the Supreme Council, divided the region between Czechoslovakia and Poland.) The Austrian delegation signed the treaty at St.-Germain-en-Laye on Sept. 10, 1919.

See also **SAINT-GERMAIN, TREATY OF.**

**Treaty of Neuilly.**—On Sept. 19, 1919, the Allied and Associated Powers presented a Bulgarian delegation with a draft treaty. In its final form it contained war crimes, reparations, and military clauses much like those in the Austrian treaty. It provided for a frontier between Bulgaria and Yugoslavia that generally favored the latter, and it required Bulgaria to surrender both Eastern and Western Thrace. The treaty was signed by the Bulgarian delegation at Neuilly-sur-Seine on Nov. 27, 1919.

See also **NEUILLY, TREATY OF.**

**Treaty of Trianon.**—The victors had planned to deal concurrently with the Austrians and with representatives of the newly independent Hungarian state, but revolutionary disturbances brought to power in Budapest a Communist regime headed by Béla Kun, and the conferees in Paris decided to wait before presenting a treaty to the Hungarians. On June 13, 1919, the Supreme Council simply sent a message to Béla Kun ordering him to withdraw Hungarian forces from the territories which by then had been assigned to Czechoslovakia and Rumania. Hungary was thus required to abandon the Pressburg (Bratislava) region, the Great Schütt, and Slovakia to the one, and Transylvania, part of the Hungarian plain, and part of the Banat to the other. When a Hungarian delegation was invited to Paris in November 1919, these new frontiers were formally provided for in the treaty presented to it, and it was asked to give up Burgenland to Austria, and Slavonia, northeast-

ern Croatia, and the remainder of the Banat to Yugoslavia. The war crimes, reparations, and military clauses were similar to those in the Austrian and Bulgarian treaties. The Hungarian delegation finally signed the treaty at Trianon on June 4, 1920.

See also **TRIANON, TREATY OF.**

**Treaty of Sévres.**—Of all the treaties, the harshest was that imposed on Turkey and signed by a Turkish delegation at Sévres on Aug. 10, 1920. Its war crimes, reparations, and military clauses were similar to those in the Austrian, Bulgarian, and Hungarian treaties, but the Sévres agreements also provided that inter-Allied commissions should remain in Turkey to ensure the fulfillment of these clauses, to devise a new judicial system for the nation, and to regulate navigation in the straits. The straits were to be open as if they were international water. Turkey was to renounce all claim to Egypt, the Sudan, and Cyprus; acknowledge the Hejaz, Syria, Mesopotamia, and Armenia as free and independent states; and cede Thrace, Crete, and most of the Aegean Islands to Greece and the Dodecanese and Kastellorizo to Italy. Smyrna and its environs were to receive autonomy under administrative control by Greece, and a local assembly was to have the right after five years to apply for incorporation in the Kingdom of Greece. Similarly, Kurdistan was to have an autonomous regime arranged by an international commission, and it was to have the right to become independent upon application to the League of Nations. The Ottoman Empire was thus to be reduced to a fragment of Turkey proper. As it turned out, however, the Treaty of Sévres was never put into force, and it was eventually replaced by the milder Treaty of Lausanne.

**Treaty of Lausanne.**—Turkish nationalists led by Mustafa Kemal refused to accept the Treaty of Sévres, and their forces drove the Greeks from Smyrna and threatened the Allied position in the Dardanelles. The Allies therefore agreed to convene a new conference with the Turks, and a treaty was signed at Lausanne on July 24, 1923. Under its terms, Turkey recovered full administrative control of its own territory and regained sovereignty over part of eastern Thrace, including the city of Edirne, and over Smyrna, Kurdistan, and Armenia. Turkish possession of the Kars and Ardahan districts had been recognized by the Soviet Union in 1921. In return, Turkey agreed to demilitarize zones around the Bosphorus and the Dardanelles and an area on the Greek and Bulgarian borders in Thrace. A separate Straits Convention, signed at Lausanne on the same day, provided that the straits should remain open except in time of war, when Turkey could close them for her own defense or to enforce her neutrality.

See also **LAUSANNE, TREATIES OF.**

**Ratification of the Treaties.**—**Nonratification by the United States.**—Despite the amendments which President Wilson had succeeded in introducing into the Covenant of the League of Nations, his Republican opponents were not assuaged. Republicans in the United States Senate were divided into three groups: one which opposed ratification of the German treaty in any form; one which wished the Senate to introduce serious amendments to the treaty or, in ratifying it, to state strong reservations about parts of it; and one which wished to enter less strong reser-

vations. These factions were known respectively as "irreconcilables," "strong reservationists," and "mild reservationists," and each had a small number of allies among senators from the President's own Democratic Party. Since the Senate Foreign Relations Committee had been so constructed that "irreconcilables" and "strong reservationists" formed a majority, it was able to delay presentation of the treaty to the Senate, and meanwhile public sentiment against the document grew. The treaty came to be opposed by many German Americans who felt that it was too harsh toward their fatherland, by Hungarian Americans who resented the settlement in the Balkans, by Italo-Americans angered by the Fiume dispute, by Sinophiles who regarded the Kiaochow clause as shameful, by liberal idealists disappointed that Wilson had compromised with so many of his points and principles, and by conservatives who feared that membership in the League might involve the United States in future economic or political difficulties.

To counteract the public swing against the treaty and to stimulate renewed enthusiasm for it, the president set out on a speaking tour of the country, but he collapsed at Pueblo, Colo., on Sept. 25, 1919, and shortly after his return to Washington suffered an incapacitating stroke. Many of his advisers concluded that there was little hope of ratification unless the Democrats compromised with the "mild reservationists," but Wilson, directing the battle from his sickbed, rejected all such suggestions. Thus when the treaty came up for a vote in the Senate on Nov. 19, 1919, Democrats insisted on ratification without reservations, and it failed of passage both when brought up in such form and when brought up with reservations attached. The same alignment holding, it failed a second time, on March 19, 1920.

The new Republican administration of Warren G. Harding, which took office in March 1921, negotiated a separate treaty of peace with Germany, signed at Berlin on Aug. 25, 1921; one with Austria, signed at Vienna on Aug. 24, 1921; and one with Hungary, signed at Budapest on Aug. 29, 1921. (The United States had not been at war with Bulgaria and Turkey.)

**Ratification by Other Powers.**—The treaties of Versailles, St. Germain, Neuilly, and Trianon had meanwhile been ratified by other signatories. The German treaty went into force on Jan. 10, 1920, and the League of Nations began functioning on Jan. 16, 1920. The Great War, as it was long called, thus officially came to a close.

See also separate biographies of the leading statesmen and diplomats; historical sections of articles on the various belligerents and neutrals; articles on the territories that changed hands; LEAGUE OF NATIONS; MIDDLE EAST—5. *History* (Modernization); TWENTIETH CENTURY—*Warfare*.

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## 16. The Postwar World

The armistices of 1918 and the treaties of 1919 and 1920 brought peace to only part of the world, for wars continued in eastern Europe, the Middle East, and Asia. In Russia civil conflict raged through 1919, and the Bolsheviks did not succeed in reconquering the Caucasus, the Ukraine, and the territory between Petrograd

(now Leningrad) and the Baltic Sea until early in 1920. In that year, they negotiated treaties recognizing the independence of Estonia, Latvia, Lithuania, and Finland. Meanwhile, however, the Polish government had come to the aid of the defeated Ukrainians, and war between Russia and Poland continued through the spring and summer of 1920. After suffering initial reverses, the Bolsheviks rallied and drove almost to the outskirts of Warsaw. The Poles, reinforced by French officers and money, then pushed them back. Peace negotiations opened in September 1920, and a treaty of peace delimiting the Soviet-Polish frontier was signed at Riga on March 18, 1921. In Hungary the Communist government of Béla Kun declared war on Rumania on April 22, 1919, only to have the Rumanians march toward Budapest, forcing Kun to flee the country on August 1. On March 1, 1920, a reactionary regency was established under Adm. Miklós (Nicholas) Horthy. In Albania a nationalist uprising early in 1920 compelled the Italians to withdraw their occupying forces and, on August 2, to recognize the nation's independence.

In Turkey, Mustafa Kemal (later Kemal Atatürk) battled from 1919 to 1922 to drive the Greeks from Smyrna (now İzmir) and to force the Allies to revise the Treaty of Sévres. In Syria nationalists rose against the French, who had been assigned a mandate over the area by the inter-Allied Conference of San Remo of April 1920; much blood was shed before the French consolidated their control over Syria proper, and the Republic of Lebanon successfully proclaimed its independence (1926). In Iraq, which the Conference of San Remo had designated as a British mandate, there were uprisings in 1920. In Arabia there was fighting in 1919 between ibn-Saud and King Husayn (Hussein) of the Hejaz, and it was not until 1925 that the former succeeded in consolidating his control over the entire peninsula. In Iran, which a treaty of Aug. 9, 1919, placed under British protection, a nationalist uprising was backed by the Soviet Union; it was only ended in February 1921 with the triumph of the British-backed military chieftain Reza Khan Pahlavi. The British treaty was denounced, and both Russians and British left the country. In Afghanistan, Emir Amanullah Khan declared war against the British in 1919, and peace was not fully restored until they recognized the complete independence of the nation in November 1921. In China civil war continued without interruption.

Nor did peace in the full sense of the term come even to western Europe. The new German Republic was tormented by insurrection in the Polish provinces in 1918 and 1919, by separatist movements in the Rhineland nurtured by the French occupying authorities, by an independent Communist republic established briefly in Bavaria in April 1919, and by the violent agitation of both Communist and right-wing nationalist groups elsewhere in the country. All of these difficulties were increased by the Allied blockade, which, continuing throughout the period of treaty making, brought much of the population to the point of starvation.

The Allies themselves, despite their hard bargaining at Paris, proved unable afterward to agree on the measures to be applied to Germany. A conference held at Spa in July 1920 determined the percentage of reparations which each of the victors should obtain from the defeated

state. Other conferences at Paris (January 1921) and London (February–March; April–May 1921) altered these percentages and fixed the payments in money and in kind that the Germans were to make. The French became increasingly irritated by the failure of the Germans to meet these obligations. They suggested repeatedly that the Allies invoke the sanctions provided in the Treaty of Versailles and occupy the Ruhr. The British opposed this suggestion and at conferences at London (December 1921) and Genoa (April 1922) proposed as partial compensation a new treaty guaranteeing the French frontiers. Nothing came of this proposal nor of further conferences at London (August and December 1922). Dissatisfied and alarmed by the fact that Germany and Russia had signed a treaty of commerce and friendship at Rapallo on April 16, 1922, the French defied the British and proceeded to occupy the Ruhr in January 1923.

The conferences which exacerbated disagreements were not, of course, the only ones held. A large assemblage of delegates met in Washington in the winter of 1921–1922 and framed a treaty of naval limitations which permitted cutbacks in capital ships by all the major maritime states; a nine-power pact providing for the maintenance of the open door for trade in China; and a four-power pact dissolving the 20-year-old Anglo-Japanese alliance and substituting for it an Anglo-American-Japanese-French compact providing for mutual consultation in the event of disturbances in the Pacific area. In 1922–1923 delegations at Lausanne framed a new Turkish treaty. For all practical purposes, however, tranquillity was not restored to Europe until 1925, when the French evacuated the Ruhr, and representatives of the major European states concluded the Locarno treaties, which included guarantees of the Franco-German and Belgo-German frontiers against aggression.

See also FAR EASTERN AFFAIRS—*From World War I to World War II*; LOCARNO, PACT OF; MIDDLE EAST—5. *History* (Modernization); NAVAL CONFERENCES—*Washington Conference (1921–1922)*.

**Political Consequences of the War.**—The war and the peace treaties obviously wrought great changes in the political geography of Europe. Germany was reduced in size, while France and Italy were enlarged. There was a large independent Poland between Germany and Russia, and the Baltic states and Finland also became independent. Where the Austro-Hungarian Empire had been, there were Czechoslovakia, a tiny Austrian republic, an independent Hungary, a greater Rumania, and a united Yugoslav state. Most of the frontier lines in the Balkans were new, and so were those on post-1920 maps of the Middle East. In general, the boundaries of states followed more closely than ever the distinguishable lines of language and nationality, though there were significant minorities of Germans in Czechoslovakia and Poland and of Magyars in Czechoslovakia and Rumania.

In Europe, however, the geographical changes brought about by the war were probably less significant than the institutional changes. Where before the war there had been 19 monarchies and 3 republics, by 1922 there were 14 republics, 13 monarchies, and 2 regencies (Albania and Hungary). And, more important still, many of the postwar states, republics and monarchies alike, had adopted or were to adopt

ideologies quite different from those that had animated either republics or monarchies before the war. The revolutionary Marxism of the Bolsheviks triumphed in Russia. Socialists governed the Austrian Republic and, for a time, Germany, and Socialist parties made electoral gains in both Britain (1923) and France (1924). In Bulgaria, in 1919, Alexander Stamboliski and his Agrarian Party took power and established a dictatorship which gave primacy to the interests of peasants. In Italy, in October 1922, Benito Mussolini and his black-shirted Fascists seized control of the government and set up a regime that boasted of suppressing civil liberties and of subordinating the individual to the interests of the state. Government, whether in representative forms, as in France and Britain, or in totalitarian forms, as in Russia, Bulgaria, and Italy (and later in Nazi Germany), sought to be of and for, if not necessarily by, the masses. Except in Poland and Hungary, where old-fashioned regimes held sway, every nation in Europe adopted programs for land redistribution and enacted some kind of social service legislation. This formed a dramatic contrast with the past, when all but a few European governments had been avowedly of, for, and by a small minority. Nor was this transformation confined to Europe, for similar movements emerged in Mexico, Peru, India, and China.

See also FASCISM; MINORITIES; NATIONALISM AND INTERNATIONALISM; SOCIAL REFORM PROGRAMS AND MOVEMENTS—*Social Reform Programs, 1918 to 1956*; SOCIALISM—*Socialist Movements in Various Countries*.

**Economic Consequences of the War.**—The fighting in Europe destroyed many of the communications lines and factories of the Continent, but most of this physical damage proved relatively easy to repair. By 1922 the production of materials like coal, iron, and steel, the output of manufactures, and railroad mileage were all higher than in 1912, and despite tariff barriers raised by the new states intra-European commerce had also staged an almost complete recovery. Many changes had, of course, taken place. Industries were turning to mass production and, where possible, were using machines in place of human labor. Partly as a result of this but even more as a result of political changes, the work day was growing shorter. The eight-hour day, which had once seemed an impossible dream, became a reality. But neither mass production nor changes in working conditions nor even changes in consumer interests, such as the general passion in western Europe and the United States for new houses and motor cars, can be attributed to the war. Insofar as economic changes are traceable to that conflict, they lie rather in the realm of finance, for the war had one clear result: it transferred the center of wealth from Europe to North America.

The European victors were left owing their former ally an aggregate of \$10 billion; when the exchanges were freed in 1919, the British pound dropped by one fifth in value as compared with the dollar, while the franc fell by 50 percent. The effort made particularly by the French to wring reparations payments from Germany was due in part to a desire to recover lost ground. The Germans, when pressed, proved unable to pay. Inflation made the German mark worthless: it stood at 4.6 million to the dollar in August 1923, and at 4.2 trillion to the dollar



in November. An international committee, headed by Charles G. Dawes of the United States, recommended that a new financial system be adopted by the Germans and that reparations claimed by the Allies be scaled down, and this Dawes Plan was adopted in 1924. But the inflation wiped out savings, worked great hardship on the German middle classes, and helped to prepare the way for Adolf Hitler's seizure of power in 1933. And, to a lesser extent, financial disturbances worked hardships on the middle classes all over Europe and thus strengthened the tendency toward government of and for the masses.

**Psychological Effects of the War.**—If the war's economic consequences were narrower than contemporaries predicted, its psychological effects were profound and were quite different from what most people of the time foresaw. During the war politicians and publicists spoke of the great days to come, when there would be no more wars, no more armaments, no more clashes between nations, and no more want. The actuality of the harsh compromises in the treaties, coupled with continued violence in eastern Europe, the Balkans, the Middle East, and Asia, mutual distrust among the victors, and a sharp recession following the immediate postwar boom, produced a widespread sense of disillusionment. Some felt that the peacemakers had not been sufficiently idealistic; others, that they had been impractical. Still others concluded that the outcome of the war had proved all governments incapable of acting in the interest of common men or had proved man's fate to be something altogether beyond man's own control. From these various moods emerged an increasingly strong pacifist movement, violent nihilist movements like that of the Nazis in Germany, an escapism that gave great popularity to esoteric poets, novelists, and painters, and a brooding fatalism that found reflection in such writings as those of Oswald Spengler and Søren Kierkegaard.

World War I had been modern civilization's most hideous experience. In some parts of western Europe it had taken the life of one young man out of four, and in the generations that matured in the 1920's and 1930's few could understand for what reason it had been fought. The experience formed a trauma in the consciousness of most of the peoples who had taken part in it, and this fact is of cardinal importance for the understanding of the events that took place in the decades after it.

See also TWENTIETH CENTURY, and the history of GERMANY and of the other countries that were involved in the war.

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## 17. Chronology

A chronological outline of the more important events leading up to World War I, the principal occurrences during the course of the war, and postwar developments are presented under the following headings: (1) prelude to war, (2) declarations of war, (3) western front, (4) eastern front, (5) Italian front, (6) colonial and Japanese campaigns, (7) Turkish campaigns, (8) Balkan campaigns, (9) naval operations, (10) peace negotiations, and (11) postwar settlements.

## PRELUDE TO WAR

1870

July 19—Franco-Prussian War begins.

Sept. 2—French surrender at Sedan.

Oct. 27—French surrender at Metz.

1871

Jan. 18—William I is proclaimed German emperor.

May 10—Treaty of Frankfurt; French lose Alsace and part of Lorraine; vow war of revenge.

1878

and Rumania Dobruja; Bosnia and Herzegovina are placed under Austrian administration.

1879

Oct. 7—Austro-German alliance is formed.

1881

June 18—Three Emperors' League (Germany, Austria-Hungary, Russia) is formed; lasts until 1887.

1882

May 20—Germany, Austria-Hungary, and Italy form Triple Alliance.

1883

Feb. 4—German colonial expansion begins with note to Great Britain on South West Africa.

1887

June 18—Reinsurance Treaty between Russia and Germany replaces Three Emperors' League; lasts until 1890.

1890

July 1—Great Britain cedes Helgoland to Germany.

1894

Jan. 4—Franco-Russian alliance is completed.

Aug. 1—Sino-Japanese War begins.

1895

April 17—Treaty of Shimonoseki ends Sino-Japanese War after Chinese defeat.

May 8—Cession of Liaotung Peninsula to Japan is reversed in final Treaty of Shimonoseki as a result of intervention of the Great Powers, particularly Germany, who arouses Japanese enmity.

1899

May 18—First Hague Conference opens; ends July 29.

Oct. 11—South African (Boer) War begins; there is an outbreak of German Anglophobia.

1900

June 12—German Reichstag passes bill to double fleet.

1902

Jan. 30—Anglo-Japanese alliance is formed.

May 31—South African War ends with Boer defeat.

Nov. 1—Italy and France secretly agree that the former will remain neutral if the latter goes to war with Germany as a result of a German attack on Russia.

1904

Feb. 8—Russo-Japanese War begins.

April 8—Entente Cordiale is concluded by Great Britain and France.

1905

Schlieffen Plan is formulated for war against France. March 22—Emperor William II states at Bremen: "God has called us to civilize the world; we are the missionaries of human progress. . . . [We are] the salt of the earth."

March 31—Visit of William II to Tangier precipitates Moroccan crisis.

June 6—German pressure forces removal of French foreign minister, Théophile Delcassé.

Sept. 5—Treaty of Portsmouth ends Russo-Japanese War.

1906

Jan. 16—Algiers Conference on Morocco opens; ends April 7 with an agreement favoring French position, which was supported by Great Britain.

1907

June 15—Second Hague Conference opens; ends Oct. 18. Aug. 31—Anglo-Russian agreement completes Triple Entente.

1908

Oct. 5—Bulgaria becomes independent.

Oct. 6—Austria-Hungary proclaims annexation of Bosnia and Herzegovina. European crisis ensues; ends March 1909.

1909

August—German Chancellor Theobald von Bethmann-Hollweg makes overtures to secure British neutrality in the event of a Continental war.



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The French rush troops of the Paris garrison to the Marne in September 1914.

Oct. 24—Italy and Russia conclude a secret agreement on Balkans and other areas.

#### 1911

July 1—German gunboat at Agadir provokes a new Moroccan crisis.

July 15—Germany demands territorial compensation from France, including all of French Equatorial Africa and French preemptive rights to Belgian Congo.

July 21—A speech by David Lloyd George in London serves as a warning to Germany.

Nov. 4—France cedes two strips of French Equatorial Africa to Germany in return for recognition of its protectorate in Morocco.

#### 1912

March—Germany endeavors to obtain an unconditional pledge of neutrality from Great Britain during any war into which Germany "might be forced." British offer a naval holiday, but a new bill is published that increases the German Navy.

May—June—Italy occupies the Dodecanese.

Oct. 6—First Balkan War begins.

#### 1913

May 30—Treaty of London ends First Balkan War, Turkey cedes territory.

June 1—Greece agrees by treaty to send troops to Serbia if the latter is attacked by Bulgaria.

June 29—Second Balkan War begins; ends Aug. 10 with Treaty of Bucharest; Romania gains territory at expense of Bulgaria.

Aug. 7—Three-year military service bill is enacted in France.

Dec. 14—Gen. Otto Liman von Sanders arrives in Turkey as head of German military mission.

#### 1914

June 28—Archduke Franz Ferdinand of Austria-Hungary and his wife are assassinated by a Serb at Sarajevo, Bosnia.

July 5—William II assures Austria-Hungary that he will support it and wage war against Russia and France if Russia aids Serbia.

July 7—Austro-Hungarian Council of Ministers decides to send Serbia a 48-hour ultimatum.

July 20—French President Raymond Poincaré and Premier René Viviani arrive in St. Petersburg; state visit ends July 23.

July 22—Germany warns Great Britain against outside interference between Austria-Hungary and Serbia.

July 23—Austria-Hungary sends its ultimatum to Serbia.

July 25—Conciliatory Serbian reply is rejected; Austria-Hungary breaks off relations with Serbia and orders partial mobilization.

July 26—Great Britain proposes a conference, proposal is rejected by Germany July 27.

July 28—Austria-Hungary and Serbia are at war.

July 29—Russia begins to mobilize.

July 31—Russia orders general mobilization, Germany proclaims state of the danger of war; Austria-Hungary orders general mobilization.

Aug. 1—Germany mobilizes.

Aug. 2—Germany sends ultimatum to Belgium; secret treaty between Germany and Turkey provides for subsequent entry of latter on side of Central Powers.

Aug. 3—Italy proclaims neutrality.

Aug. 4—Great Britain sends ultimatum to Germany.

#### DECLARATIONS OF WAR

##### 1914

July 28—Austria-Hungary against Serbia.

Aug. 1—Germany against Russia.

Aug. 3—Germany against France.

Aug. 4—Great Britain against Germany at expiration of ultimatum at midnight; Germany against Belgium.

Aug. 5—Montenegro against Austria-Hungary.

Aug. 6—Austria-Hungary against Russia; Serbia against Germany.

Aug. 9—Montenegro against Germany; Austria-Hungary against Montenegro.

Aug. 12—Great Britain against Austria-Hungary.

Aug. 13—France against Austria-Hungary.

Aug. 22—Austria-Hungary against Belgium (received Aug. 28).

Aug. 23—Japan against Germany.

Aug. 25—Japan against Austria-Hungary.

Nov. 1—Russia against Turkey.

Nov. 2—Serbia against Turkey.

Nov. 5—Great Britain against Turkey; France against Turkey.

#### 1915

May 23—Italy against Austria-Hungary.

June 3—San Marino against Austria-Hungary.

Aug. 21—Italy against Turkey.

Oct. 14—Bulgaria against Serbia.

Oct. 15—Great Britain against Bulgaria; Montenegro against Bulgaria.

Oct. 16—France against Bulgaria; Serbia against Bulgaria.

Oct. 19—Italy against Bulgaria; Russia against Bulgaria.

#### 1916

March 9—Germany against Portugal.

March 15—Austria-Hungary against Portugal.

Aug. 27—Romania against Austria-Hungary; Italy against Germany (to take effect Aug. 28).

Aug. 28—Germany against Romania.

Aug. 30—Turkey against Romania.

Sept. 1—Bulgaria against Romania.

#### 1917

April 6—United States against Germany.

April 7—Cuba against Germany; Panama against Germany.

July 2—Greece against Germany, Austria-Hungary, Turkey, and Bulgaria.

July 22—Siam against Germany and Austria-Hungary.

Aug. 4—Liberia against Germany.

Aug. 14—China against Germany and Austria-Hungary.

Oct. 26—Brazil against Germany.

Dec. 7—United States against Austria-Hungary.

Dec. 10—Panama against Austria-Hungary.

Dec. 16—Cuba against Austria-Hungary.

#### 1918

April 23—Guatemala against Germany.

May 8—Nicaragua against Germany and Austria-Hungary.

May 23—Costa Rica against Germany.

July 12—Haiti against Germany.

July 19—Honduras against Germany.

#### BREAKING OF DIPLOMATIC RELATIONS

##### 1917

Feb. 3—United States with Germany.

March 14—China with Germany.

April 8—Austria-Hungary with the United States.

April 10—Bulgaria with the United States.

April 13—Bolivia with Germany.

April 20—Turkey with the United States.

April 27—Guatemala with Germany.

May 17—Honduras with Germany.

May 19—Nicaragua with Germany.

Sept. 21—Costa Rica with Germany.

Oct. 6—Peru with Germany.

Oct. 7—Uruguay with Germany.

Dec. 7—Ecuador with Germany.

#### WESTERN FRONT

##### 1914

Aug. 2—Germans invade Luxembourg.

Aug. 4—Germans invade Belgium.

Aug. 7—Germans enter Liège; French invade Alsace; British troops begin to land in France.



UPI/BETTMANN NEWSPHOTOS

Trench warfare begins as the Western Front is stabilized in October 1914 after the Battle of the Yser.



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A British gun crew on the Somme in 1916 wears gas masks. The Germans introduced gas warfare in April 1915.

- Aug. 8—Belgian Army falls back; limited French success is achieved in Alsace.
- Aug. 9—French cavalry enters Belgium.
- Aug. 10—French advance in Lorraine.
- Aug. 20—Germans enter Brussels.
- Aug. 21—Reverses force French from Alsace-Lorraine.
- Aug. 22—French are defeated at Charleroi.
- Aug. 23—Namur falls to Germans; Battle of Mons begins.
- Aug. 24—British fall back from Mons; a general Allied retreat takes place.
- Aug. 25—Gen. Joseph Joffre orders troops from the west to build up Sixth Army near Paris.
- Aug. 26—Battle of Le Cateau; British are driven back.
- Aug. 27—Lille and Mézières are occupied by the Germans.
- Aug. 31—French Army falls back to line Aisne-Reims-Verdun.
- Sept. 1—Germans take Soissons.
- Sept. 2—Germans reach the Marne.
- Sept. 3—French government moves to Bordeaux.
- Sept. 5—Battle of the Marne begins.
- Sept. 6—French Sixth Army attacks German flank from west in Battle of the Ourcq, with modest success.
- Sept. 9—Marne battle ends; Germans begin retreat.
- Sept. 14—First Battle of the Aisne begins (ends Sept. 28); this is the introduction of trench warfare.
- Sept. 18—Stalemate on the Aisne, opponents begin series of attempts to outflank each other on the west, which develops into the Race for the Sea.
- Sept. 23—Germans take St.-Mihiel, forming salient.
- Oct. 9—Germans take Antwerp.
- Oct. 12—First Battle of Ypres begins (ends Nov. 11) as Germans try to break front; Allies hold.
- Oct. 16—Battle of the Yser ends race for the sea; neither side succeeds in outflanking the other; this is beginning of the stabilized front.

#### 1915

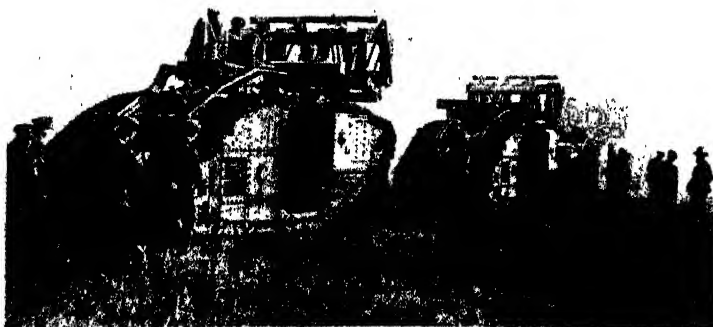
- During the year the front remains essentially stabilized. There are local actions with few gains.
- Jan. 8—Battle of Soissons begins (ends Jan. 15); French drive is repulsed.
- Feb. 3—German attacks in Champagne are repulsed.

- March 10—Battle of Neuve-Chapelle; British achieve limited success in three-day battle.
- March 14—Battle of St.-Eloi begins (ends March 15); initial German gains are erased by British counterattacks.
- April 22—Second Battle of Ypres begins (ends May 24-25), costly and futile attacks are made by both sides; Germans introduce poison gas in war.
- May 9—Second Battle of Artois begins (ends June 18), French make small gains at heavy cost.
- May 15—Battle of Festubert begins (ends May 25); Allies obtain limited successes.
- June 20—German offensive in the Argonne begins (ends July 14); attempt to break French line fails.
- Sept. 25—Allied offensives begin at Loos and in Champagne (end Nov. 6); good initial successes are obtained; fighting is violent, however, and final gains are limited.

#### 1916

- During the year only two major engagements take place, at Verdun and on the Somme, 38 air raids, mostly by zeppelins, are made over England.
- Feb. 21—Battle of Verdun begins; Germans attack to deplete limited French manpower.
- Feb. 25—Germans advance 3 miles (5 km) at Verdun; capture Fort Douaumont.
- March 16—Five German attacks are repulsed at Verdun.
- June 7—Germans take Fort de Vaux at Verdun.
- July 1—Franco-British offensive begins Battle of the Somme.
- July 3—Allies obtain local successes on the Somme.
- July 12—Battle of the Somme continues; British take Mametz Wood.
- July 14—British capture Trônes Wood; first phase of Battle of the Somme ends.
- July 17—British capture German second Somme defense line.
- Sept. 15—British introduce tanks in war on the Somme.
- Oct. 5—British and French have limited successes on the Somme.
- Oct. 13—Forty Allied bombers raid factory in Oberndorf.
- Nov. 13—Battle of the Ancre (part of Somme battle) begins (ends Nov. 18); British achieve success.

BETTMANN ARCHIVE/PG



British tanks move toward the front in 1916. The British were the first to use tanks, in September 1916 during the Battle of the Somme, but did not score a major success with them until late in 1917.

- Nov. 18—Battle of the Somme ends; there are 650,000 German, 420,000 British, and 185,000 French casualties.  
 Dec. 12—Gen. Robert Georges Nivelle succeeds Joffre in command of the French.  
 Dec. 15—Massive French attacks at Verdun make important gains.  
 Dec. 18—Battle of Verdun ends; there are 550,000 French and 450,000 German casualties.

## 1917

- February—The Allies, now possessing superior manpower, plan offensive in Noyon salient.  
 Feb. 23—Apprised of coming offensive, Germans begin withdrawal from salient to Hindenburg Line.  
 March 18—Following up the German withdrawal, British occupy Péronne, and French Noyon.  
 April 5—Germans complete withdrawal.  
 April 6—United States enters war.  
 April 9—Battle of Arras begins (ends May 3); Canadians capture Vimy Ridge.  
 April 16—Second Battle of the Aisne (ends May 9); Nivelle hurls French against impregnable defenses with staggering losses; French troops mutiny.  
 May 3—British break Quéant position; move on Cambrai.  
 May 4—French take Craonne and Chemin des Dames on the Aisne.  
 May 15—Gen. Philippe Pétain replaces Nivelle in command of the French.  
 June 7—Battle of Messines begins (ends June 8); British capture ridge.



Led by Gen. John J. Pershing (hand on sword), the first American fighting contingent lands in France in 1917.



BETTMANN ARCHIVE

French shock troops with tank support prepare to go over the top. Tanks could overrun trenches.

- April 9—Lys offensive begins; second German drive, designed to shatter British, wins 10 miles (16 km); it is stopped April 29 by lack of reserves and Allied counterattacks, and Germans are left in salient.  
 April 14—Gen. Ferdinand Foch is appointed supreme Allied commander.  
 May 27—Aisne offensive (third German drive), designed to break French, reaches Marne in four days.  
 May 28—Battle of Cantigny; in first independent American operation, 1st Division captures Cantigny.  
 June 2—French hold on the Marne; Americans stop German crossings of the river at Château-Thierry.  
 June 6—Aisne offensive ends; Germans are left in salient.  
 June 9—Noyon-Montdidier offensive begins; the fourth German drive, it is designed to threaten Paris, French hold with new defensive system, and drive ends June 13.  
 July 15—Champagne-Marne offensive (Second Battle of the Marne) begins (ends July 17), the last German drive, it is stopped by the French.  
 July 18—Foch begins to reduce German salients prior to launching general attack; Aisne-Marne offensive against Marne salient begins; 8 American divisions participate.  
 July 27—Germans in Marne salient are in general retreat.

- June 25—First American fighting troops land in France.  
 July 31—Third Battle of Ypres begins; British continue attacks until Nov. 6 to occupy Germans while French recuperate from Aisne debacle; there are tremendous casualties but meager successes.  
 Aug. 20—French make limited gains near Verdun.  
 Nov. 6—Canadians capture Passchendaele Ridge; Third Battle of Ypres ends.  
 Nov. 9—Allies form Supreme War Council.  
 Nov. 20—Battle of Cambrai begins (ends Dec. 3); British first massed tank attack surprises Germans and breaks line; lack of reserves limits British success.  
 Nov. 30—Germans counterattack at Cambrai (attack ends Dec. 1).  
 Dec. 4—British withdraw at Cambrai, losing much ground (withdrawal ends Dec. 7).

## 1918

- Collapse of Russia permits transfer of German troops to west, giving the Germans numerical superiority; they plan supreme effort to win in France before United States can intervene.  
 March 21—Somme offensive begins; the first German drive to split French and British, it achieves substantial initial gains.  
 March 22—A German breakthrough at St-Quentin on Somme forces British retreat.  
 March 23—Germans reach Somme River; Big Bertha begins harassing firing on Paris from 74 miles (119 km) away.  
 March 28—Germans are held up in north on Somme but advance in south.  
 April 4—German Somme offensive runs down after gain of 30 miles (50 km) for lack of reserves and supplies; Germans are left in salient.

An Australian soldier tends a fallen comrade at the Third Battle of Ypres (July-November 1917).

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BETTMANN ARCHIVE

An American aviator sights his machine gun. Volunteer airmen saw action before the U.S. declared war in 1917.

- Aug. 6—Allies reach the Vesle and eliminate the Marne salient.
- Aug. 8—British and French begin attacks to reduce Amiens salient.
- Aug. 18—French advance between Oise and Aisne rivers in Amiens salient.
- Aug. 21—British achieve success in Battle of the Bapaume in Amiens salient (battle ends Aug. 31); German troops begin to break.
- Sept. 3—Germans retreat to Hindenburg Line; Amiens salient is reduced.
- Sept. 6—Germans complete withdrawal from Lys salient.
- Sept. 12—Newly created American First Army, aided by French, attacks St.-Mihiel salient and gains 5 miles (8 km), Battle of Epehy, on Cambrai front, begins (ends Sept. 18); British obtain successes.
- Sept. 13—Germans withdraw from St.-Mihiel salient under American and French pressure.
- Sept. 26—Foch's final general offensive begins; Americans and French begin Meuse-Argonne offensive and advance several miles; 1,200,000 Americans participate.
- Sept. 27—British start Second Battle of Cambrai and Battle of St.-Quentin, piercing Hindenburg Line.
- Sept. 28—Battle of Flanders begins with Anglo-Belgian success on 23-mile (37-km) front.
- Oct. 3—In the Meuse-Argonne offensive there occurs stiff American fighting in the Argonne Forest.
- Oct. 5—Second Battle of Cambrai and Battle of St.-Quentin end; Germans fall back.
- Oct. 8—A great British-French-American advance on St.-Quentin-Cambrai front progresses 3 miles (5 km).
- Oct. 9—Advance continues; British take Cambrai.
- Oct. 10—British capture Le Cateau.
- Oct. 14—Allies start Flanders offensive and advance 5 miles (8 km).
- Oct. 17—Battle of the Selle; British-American attack on 9-mile (14-km) front captures part of Selle position.
- Oct. 19—Belgians occupy Zeebrugge and attack Bruges.
- Oct. 25—Stiff American fighting occurs north of Verdun in Meuse-Argonne offensive.
- Oct. 27—Gen. Erich F. W. Ludendorff, German supreme commander, resigns.
- Nov. 3—Americans and French clear Argonne Forest and move into open country; French reach the Aisne.
- Nov. 4—British-French offensive takes Oise-Sambre Canal.
- Nov. 6—Germans are in general retreat; Americans and French reach Meuse River at Sedan; German armistice delegates leave Berlin for western front.
- Nov. 11—Armistice is signed at 5 A.M.; firing stops at 11 A.M.; almost 2,000,000 Americans are now in France.
- Nov. 18—Belgians reenter Brussels.
- Dec. 1—British and American troops cross German frontier.
- Dec. 8—Americans enter their occupation zone at Koblenz.
- Dec. 9—French enter their occupation zone at Mainz.
- Dec. 12—British enter their occupation zone at Cologne.

## EASTERN FRONT 1914

- Aug. 10—Austrians invade southern Russian Poland and aim for Lublin.
- Aug. 17—Russian First Army invades East Prussia from the east; Germans attack it unsuccessfully in Battle of Stallupönen.
- Aug. 18—Russians invade Galicia from the east.
- Aug. 20—In East Prussia, Germans fall back in Battle of Gumbinnen; Second Russian Army moves into East Prussia from south to pinch off Germans; Germans move south to meet Second Army.
- Aug. 23—Gen. Paul von Hindenburg and Maj. Gen. Erich F. W. Ludendorff take command in East Prussia; in Galicia, Russians are driven back in Battle of Kraśnik (battle ends Aug. 25).
- Aug. 24—In East Prussia, Russian Second Army is repulsed in Battle of Frankenhau.
- Aug. 26—In Galicia, Austrians almost encircle Russians in Battle of Komarov but retire Sept. 1. South of Komarov, Austrians and Russians clash in Battle of the Gniva Lipa (battle ends Aug. 30); Austrians are put to rout; in East Prussia, Battle of Tannenberg begins.
- Aug. 29—Battle of Tannenberg ends; Russian Second Army is surrounded and decimated.
- Sept. 3—In Galicia, Russians occupy Lemberg.
- Sept. 10—Germans drive Russian First Army from East Prussia back into Poland, beginning three-day First Battle of the Masurian Lakes.
- Sept. 11—Austrians are severely beaten in Battle of Rawa Ruska in Galicia and withdraw to Carpathian Mountains 100 miles (160 km) to rear; Russians follow.
- Sept. 27—Russians push toward Carpathians.
- Sept. 28—German Ninth Army arrives in Galicia to bolster sagging Austrians; Austro-German advance begins.
- Oct. 6—Russians fall back in Poland and Galicia.
- Oct. 12—Germans advance to within 12 miles (19 km) of Warsaw.
- Oct. 16—Austrians reach line of San River.
- Oct. 17—Russian reinforcements stop Germans at Warsaw.
- Oct. 21—Germans retreat from Warsaw, and Austrians from the San.
- Nov. 1—Germans and Austrians are back on their starting line.
- Nov. 2—Russians drive Germans from Poland and reenter East Prussia.
- Nov. 4—German Ninth Army begins to move north from Galicia to attack Russian flank, in Galicia, Austrians are defeated at Jarosław.
- Nov. 10—Russians continue advance in East Prussia.
- Nov. 11—German Ninth Army attacks Russian flank, beginning Battle of Łódź.
- Nov. 14—Germans begin drive against Russians in East Prussia; Russians fall back.
- Nov. 16—Russian line is pierced in Battle of Łódź, Russians fall back.
- Nov. 21—Russian reinforcements trap Germans at Łódź.
- Nov. 24—Germans extricate themselves from Łódź trap and draw back flank; Battle of Łódź ends.
- Dec. 6—Russians fall back 30 miles (50 km) from Łódź; Germans follow.
- Dec. 25—All quiet on the eastern front.

## 1915

- Jan. 4—Russians begin advance into Bukovina.
- Jan. 17—Russians hold most of Bukovina.
- Jan. 31—Germans attack Russians at Bolimów to divert attention from major offensive being prepared in north, tear gas is used for first time.
- Feb. 7—Winter Battle of Masuria begins (ends Feb. 21); Germans encircle Russian Tenth Army near Neman River and capture 100,000 prisoners; Austrians launch attack in Carpathians to assist German attack, but it fails.
- Feb. 18—Austrians retake Czernowitz.
- Feb. 28—Germans begin withdrawal from northern Poland.
- March 22—Przemyśl, under siege since Nov. 12, 1914, surrenders to the Russians.
- April 28—Field Marshal August von Mackensen's German Eleventh Army arrives on Carpathian front to save Austrian Army, threatened with destruction by the Russians.
- May 2—Mackensen and Austrians launch huge offensive in Carpathians.
- May 4—Mackensen breaks Russian line between Gorlice and Tarnów, Russians lose 140,000 prisoners and 100 guns, and begin hasty retreat.
- May 11—Russians reach San River, 80 miles (130 km) to rear.
- May 17—Russians are forced from the San and begin a 20-mile (32-km) retreat.
- June 2—Germans capture Przemyśl.
- June 12—Russian retreat continues; Germans follow it up.
- June 22—Austrians recapture Lemberg and Galicia.
- July 16—Battle of Krassnóv begins (ends July 18); Russians are defeated.
- July 30—Germans occupy Lublin.
- July 31—Germans occupy Kholm.





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Russian infantry slog along a road in Galicia. Russia eventually mobilized 12 million men, but to no avail.

- Aug. 4-5-Germans enter Warsaw; Russians prepare to evacuate Riga.
- Aug. 7-Germans are repulsed near Riga.
- Aug. 25-Germans take Brest-Litovsk.
- Sept. 5-Czar Nicholas II takes command of Russian armies.
- Sept. 16-Germans take Pinsk.
- Sept. 30-Massive Russian withdrawal of almost 300 miles (500 km) ends; Germans and Austrians, worn down, halt.
- Oct. 3-Great battle for Dvinsk begins.
- Oct. 10-German attack on Dvinsk fails.
- Nov. 11-Russians drive Germans back from Riga.

#### 1916

- Feb. 2-Austrians and Germans fight in Bukovina.
- March 18-Russians start strong attack at Lake Naroch and make impressive initial gains against Germans.
- March 26-Lake Naroch offensive bogs down in bad weather.
- March 30-Germans regain lost ground at Lake Naroch.
- June 4-In an offensive led by Gen. Aleksei Brusilov, Russians launch massive surprise attack south of Pripet Marshes.
- June 6-Russians capture Lutsk.
- June 10-Russians pierce Austrian front to a depth of 50 miles (80 km).
- June 17-Russians capture Czernowitz.
- June 30-Russians win great victories at both ends of line, there are 700,000 Austro-German casualties.
- July 4-A Russian attack in the north makes gains and is then halted by Germans, both sides rush to concentrate their forces on southern front; 15 German and 8 Austrian divisions are brought from other fronts to stop Brusilov offensive.
- July 28-A series of bloody battles begins.
- August-There are persistent attacks by both sides, with only small gains.
- Sept. 20-Stiff opposition and heavy losses in men and materials halt Brusilov offensive.
- Oct. 22-Russians sustain reverses in Galicia.

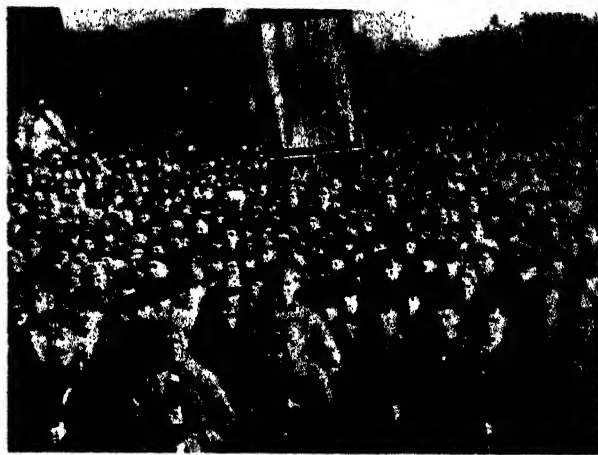
German troops on the Eastern Front wait for the signal to begin firing. This front was never long stabilized.

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#### 1917

- Jan. 5-Russian offensive begins near Riga.
- Feb. 1-Russian line is broken near Halicz.
- Feb. 11-Germans are driven back near Halicz.
- March 12-Russian Revolution begins.
- March 15-Russian government is overthrown; czar abdicates.
- May 4-Russians attack in Romania; disorganization of Russian armies begins.
- July 1-Brusilov begins offensive in Galicia.
- July 24-Counterattacking Germans drive Russians back in Bukovina.
- Aug. 3-Germans take Czernowitz.
- Sept. 3-Russians are driven from Riga.
- Nov. 6-7-Bolsheviks seize power in Petrograd.
- Nov. 8-Congress of Soviets calls for peace.
- Dec. 2-Hostilities are suspended on eastern front.
- Dec. 22-Peace negotiations are opened at Brest-Litovsk.



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Russians in Petrograd demonstrate for "peace, land, and bread" in April 1917, following the fall of the czar.

#### 1918

- Feb. 10-Leon Trotsky, dissatisfied with German terms, unilaterally declares war at an end.
- Feb. 18-Germans renew fighting and drive eastward.
- March 3-Bolsheviks sign peace treaty at Brest-Litovsk.

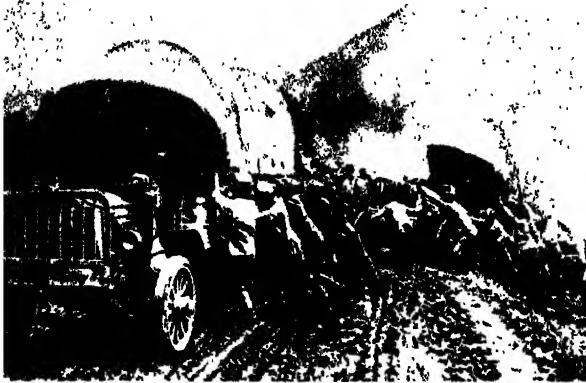
#### ITALIAN FRONT

##### 1915

- April 26-Secret Treaty of London is signed by Italy, France, Great Britain, and Russia; Italy is to enter war on Allied side in return for territorial gains in the Tirol, on the Adriatic coast, and elsewhere.
- May 23-Italy enters the war; makes limited attacks up to June 16 to gain positions for offensive.
- June 23-First Battle of the Isonzo begins (ends July 7); this is first of 11 battles launched by Italians against Austrians on the Isonzo River, attacks are made against Carso Plateau and Gorizia with small gains.
- July 18-Second Battle of the Isonzo begins (ends Aug. 3); Italian attacks against the Carso make only small gains.
- Oct. 18-Third Battle of the Isonzo begins (ends Nov. 3); attacks on the Carso and to outflank Gorizia make small gains.
- Nov. 10-Fourth Battle of the Isonzo begins (ends Dec. 2); attacks on both sides of Gorizia fail; in first 4 Isonzo battles the Italians lose 275,000 men, and the Austrians 165,000.

##### 1916

- March 8-Fifth Battle of the Isonzo begins (ends March 17); attack is stopped by bad weather; there are no gains.
- May 15-Asiago offensive begins (ends June 17); Austrians launch strong attack in the Trentino and capture Asiago, but end bitter fighting to send troops to meet Brusilov offensive on Russian front.
- Aug. 6-Sixth Battle of the Isonzo begins (ends Aug. 17); Italians capture Gorizia and bridgehead over the Isonzo beyond the town.
- Sept. 14-Seventh Battle of the Isonzo begins (ends Sept. 17); an attempt to enlarge the bridgehead makes negligible gains.



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Italians bring up reinforcements in the fighting for the Carso (Karst) Plateau south of Gorizia in 1916.

Oct. 10—Eighth Battle of the Isonzo begins (ends Oct. 12); a second attempt to enlarge the bridgehead also makes negligible gains.

Nov. 1—Ninth Battle of the Isonzo begins (ends Nov. 4); a third attempt is made to enlarge the bridgehead; a small hold is gained on the Carso.

1917

May 12—Tenth Battle of the Isonzo begins (ends June 8); Italians widen hold on the Carso and make small gains beyond Plava.

Aug. 19—Eleventh Battle of the Isonzo begins (ends Sept. 12); Italians break Austrian position beyond Plava; Austrians retreat 5 miles (8 km).

Oct. 24—Battle of Caporetto begins (ends Nov. 12); Germans join Austrians on Isonzo front and launch strong surprise attack; Italians are routed and retreat 70 miles (110 km) to Piave River; they lose 320,000 men.

Dec. 5—Austro-German offensive on Asiago Plateau makes limited gains.

Dec. 24—Italians regain several positions on Asiago front.

1918

Jan. 29—Italians pierce enemy line near Asiago.

June 15—Battle of the Piave begins (ends June 24); a major Austrian attack across the Piave is beaten back by the Italians.

Oct. 24—Battle of Vittorio Veneto begins (ends Nov. 4); Italians shatter Austrian lines, Austrians flee, losing 500,000 prisoners.

Nov. 3—Italians take Trento; armistice is signed for Italian front, effective Nov. 4.

#### COLONIAL AND JAPANESE CAMPAIGNS

1914

There are British and German border raids in East Africa through the end of the year.

Aug. 7—British and French invade German Togoland.

Aug. 20–27—British and French invade German Cameroons.

Aug. 23—Tsingtao is bombarded by Japanese.

Aug. 26—Togoland is captured by British and French.

Aug. 29—New Zealand expedition captures Western Samoa.

September—Japanese occupy German Pacific islands north of the equator.

Sept. 17—Australians complete capture of northeastern New Guinea.

Sept. 19—Union of South Africa forces capture Luderitz in German Southwest Africa.

Sept. 27—French and British amphibious force captures Duala in Cameroons.

Oct. 9—Rebellion breaks out in Union of South Africa.

Nov. 4—British fail in attempt to capture Tanga in German East Africa.

Nov. 7—Tsingtao is captured by Japanese.

1915

British and German border raids occur all year in East Africa.

Feb. 3—Rebellion in South Africa is quelled.

May 12—Union of South Africa forces capture Windhuk in German Southwest Africa.

July 9—Germans in German Southwest Africa cut off, surrender.

1916

Jan. 1—Yuande, principal German base in the Cameroons, is captured by the British.

Feb. 18—Last Germans in Cameroons surrender.

March 5—Combined British-Belgian-Portuguese invasion of German East Africa begins.

July—British occupy northern half of German East Africa.

Sept. 3—Dar es Salaam, key port in German East Africa, is captured by British.

1917

Nov. 28—Allies capture half of German forces in East Africa.

Dec. 1—Allies occupy all of German East Africa.

1918

Nov. 25—Last members of German East Africa garrison surrender to British in Rhodesia after 1,600-mile (2,580-km) chase.

#### TURKISH CAMPAIGNS

Dardanelles

1914

Nov. 3—British Navy bombards outer Dardanelles forts.

1915

Feb. 19—British begin naval attack to force straits.

March 18—Naval attack fails, and fleet withdraws.

April 25—British troops land on Gallipoli Peninsula, gain beachheads at Anzac Cove and Cape Helles.

May 6—Helles force attacks to enlarge beachhead (attack ends May 8); no gains are made.

June 4—Second Helles force attacks with minor success.

July 12—Third Helles attack begins; ends July 13 with little success; the total gain in all attacks is 3 miles (5 km).

Aug. 6—General British attack begins; troops land at Suvla Bay.

Aug. 9—British are pinned down in all sectors.

Aug. 15—A renewed British attack fails.

Aug. 21—Another attack fails.

Dec. 20—British troops are evacuated from Anzac and Suvla Bay.

1916

Jan. 9—British troops are evacuated from Helles; campaign ends in complete failure.

Mesopotamia

1914

Nov. 7—British land in Mesopotamia opposite Ahadan.

Nov. 22—British occupy Basra.

Dec. 9—British move north to Al Qurna.

1915

April 12—Turks attack British at Basra; attack fails, and they flee April 14.

May 16—British occupy Ahwaz to protect oil pipeline.

June 3—British capture Amara on the Tigris.

July 25—British capture Nasiriyah on the Euphrates.

Sept. 22—British advance on Kut begins.

Sept. 28—British rout Turks at Samarra and enter Kut.

Oct. 5—British reach Al Azziya.

Nov. 11—British start north for Baghdad.

Nov. 22—British attack Turks at Ctesiphon; capture front line.

Nov. 25—Turks hold firm; British withdraw southward.

Dec. 3—British halt retreat at Kut.

Dec. 7—Turks surround British in Kut.

Three wounded Turks are brought in by British soldiers during the Allies' futile Gallipoli campaign of 1915.

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Arabs take to their camels against Turkish forces in the Hejaz after revolting against the sultan in 1916.

## 1916

- Jan. 21—First British attempt to relieve Kut fails.
- March 8—Second British attempt is beaten back.
- April 22—Third British attempt fails.
- April 29—British garrison at Kut surrenders.
- Dec. 13—British advance toward Kut.

## 1917

- Feb. 24—British force Turkish retreat; reoccupy Kut Feb. 25.
- March 5—British advance toward Baghdad.
- March 11—Turks evacuate Baghdad; British occupy city.
- Sept. 29—British occupy Ramadi on the Euphrates.
- Dec. 9—Turks are driven from Khanaqin.

## 1918

- March 9—British capture Hit.
- Oct. 23—British begin advance to Mosul.
- Oct. 30—Turks are surrounded and captured at Sharqat; armistice is declared, effective Oct. 31.

## Egypt and Palestine

## 1914

- Dec. 18—British proclaim protectorate over Egypt.

## 1915

- February—Turkish attempts to capture Suez Canal are repulsed.

## 1916

- June 5—Hussein Ibn Ali, sharif of Mecca, proclaims Arab revolt against Turks.
- Aug. 4–5—Turks are badly beaten at El Rumana, British start advance to Palestine border.
- Dec. 21—British advance to El Arish.

## 1917

- January—British arrive at Palestine border.
- March 26—First Battle of Gaza begins (ends March 27); British attack Turks but are repulsed.
- April 17—Second Battle of Gaza begins (ends April 19); British attacks are again repulsed.
- Oct. 31—Third Battle of Gaza begins (ends Nov. 7); Turks are outflanked and forced to withdraw.
- Nov. 13—Battle of Junction Station begins (ends Nov. 14); Turks are defeated.
- Dec. 9—British capture Jerusalem.

## 1918

- April—Five British divisions are transferred to western front and are replaced by Indian troops.
- Sept. 19—Battle of Megiddo takes place; Turks are put to flight.
- Oct. 1—British take Damascus.
- Oct. 26—British take Aleppo.
- Oct. 30—Armistice is declared, effective Oct. 31.

## Caucasus

## 1914

- Dec. 29—Turks, advancing on Kars, are badly defeated by Russians near Sarikamış in battle ending Jan. 2, 1915.

## 1915

Russians push back Turks north of Lake Van.

## 1916

- Jan. 17—Russian offensive on Lake Van-Black Sea front begins.

- Feb. 12–16—Erzurum, Turkey, falls to Russians.
- April 17—Russians capture Trebizond.
- July 25—Russians capture Erzincan; advance bogs down; front is stabilized for rest of the year.

## 1917

- March 12—Russian Revolution begins; Caucasus troops remain loyal.
- Allies to Caucasus army are cut off.
- Troops begin to abandon front and return to Russia.

## 1918

- Feb. 18—Turks begin advance to Baku oilfields.
- Feb. 24—Turks reoccupy Trebizond.
- March 12—Turks reoccupy Erzurum.
- April 15—Turks reach Batumi.
- April 27—Turks capture Kars.
- May–June—Armenians and Georgians oppose Turkish advance; Germans and Turks clash at Tbilisi.
- Aug. 4—British detachment reaches Baku.
- Sept. 14—Turks force British to evacuate Baku.
- Oct. 30—Armistice is declared, effective Oct. 31.

## BALKAN CAMPAIGNS

## 1914

- July 29—Austrians bombard Belgrade; Serbs evacuate city.
- Aug. 7—Serbs enter Bosnia.
- Aug. 12—Austrians cross Drina River in first invasion of Serbia.
- Aug. 16—Battle of the Jadar begins (ends Aug. 19); Austrians are defeated.
- Aug. 20—Austrians retreat back across border.
- Sept. 8—Second Austrian invasion begins; it makes little progress.
- Sept. 16—Invasion is halted; Austrians regain bridgeheads.
- Sept. 23—Serbs and Montenegrins approach Sarajevo.
- Oct. 4—Advance is turned back in Sarajevo area.
- Nov. 5—Albanian invasion of Montenegro is checked; Austrians begin third invasion of Serbia.
- Nov. 11—Serbs are forced back from borders.
- Nov. 15—Austrians capture Valjevo.
- Nov. 29—Serbs evacuate Belgrade; Austrians occupy city Dec. 2.
- Dec. 3—Serbian armies counterattack all along front.
- Dec. 8—Austrians are defeated in Battle of the Rudnik Ridges.
- Dec. 9—Austrians begin retreat.
- Dec. 15—Austrians are driven from Serbia; invasion ends.

## 1915

- Feb. 2—Montenegrins repulse Austrians in Hercegovina.
- Aug. 16—Austrian attack on Montenegrin border is repulsed.
- Sept. 6—Secret alliance is concluded by Bulgaria, Germany, and Austria-Hungary.
- Sept. 22—Treaty whereby Turkey cedes territory to Bulgaria is ratified.
- Oct. 1—Austro-German forces concentrate on Serbian border.
- Oct. 3—Bulgarians mass on Serbian border; Anglo-French forces begin to land at Salonika, Greece.
- Oct. 7—Austrians and Germans invade Serbia.
- Oct. 9—Austrians occupy Belgrade.

Austrian gunners fire on a Serbian position in August 1914. The initial Austrian attacks were unsuccessful.

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Britain's Grand Fleet patrols the North Sea. Churchill ordered it to its war base before Germany mobilized.

Oct. 11-Bulgarians invade Serbia.  
Oct. 14-Serbs are overwhelmed on all fronts.  
Oct. 30-Allied Salonika force enters Serbia.  
Nov. 5-Bulgarians capture Niš.  
Dec. 2-Serbs withdraw from Bitolj; it is occupied by Bulgarians Dec. 5.  
Dec. 9-Allied Salonika force retreats from Serbia.  
Dec. 15-Remnants of Serbian Army begin to reach Albanian coast.

#### 1916

Jan. 15-First Serbian troops are evacuated to Corfu; evacuation is completed Feb. 10.  
Jan. 25-Montenegro accepts Austrian terms.  
July 2-Skirmishes occur on Salonikan front.  
July 25-Serbs arrive at Salonika from Corfu.  
Aug. 17-Secret Treaty of Bucharest, whereby Romania is to receive territory in exchange for attack on Austria-Hungary, is signed by Romania and Allies; Central Powers' offensive against Salonika is halted.  
Aug. 27-Romania joins Allies; invades Transylvania Aug. 28.  
Sept. 1-Field Marshal August von Mackensen's Danube Army crosses Romanian border.  
Sept. 10-Allied Salonika offensive begins (ends Nov. 19); limited gains include capture of Bitolj.  
Sept. 16-Mackensen's advance threatens Constanța railroad.  
Sept. 20-Russo-Romanian army halts Mackensen.  
Oct. 7-Romanian advance in Transylvania is turned back.  
Oct. 20-Mackensen resumes offensive in Dobrudja.  
Oct. 23-Mackensen captures key port of Constanța.  
Oct. 25-Mackensen captures Cernavodă and begins move westward to Svishtov.  
Nov. 10-Romanians are ejected from Transylvania; Gen. Erich von Falkenhayn follows into Romania.  
Nov. 23-Mackensen crosses the Danube and heads for Bucharest.  
Dec. 1-Romanian counterattack fails; Mackensen and Falkenhayn drive for Bucharest.  
Dec. 6-Bucharest and Ploesti oilfields are captured; Russo-Romanian armies are put to flight.

#### 1917

Jan. 7-Germans suspend operations against Romania.  
May-Allied Salonika offensive is stalled; gains are limited.  
June 12-Pro-German King Constantine I of Greece abdicates.  
June 27-Pro-Allied Eleutherios Venizelos resumes premiership.  
July 2-Greece joins Allies.  
Dec. 9-Romania signs armistice.

#### 1918

April 15-Greeks cross Struma River; occupy towns in Serrai area.  
May 7-Treaty of Bucharest is signed by Romania and Central Powers; Dobrudja is ceded to Bulgaria.  
Sept. 1-British advance up Vardar Valley.  
Sept. 14-French and Serbs advance in Serbia.  
Sept. 17-Allied advance gains 20 miles (32 km).  
Sept. 19-Allies cross the Vardar River; Bulgarians are in flight.  
Sept. 26-British take Strumica; Serbs take Veles.  
Sept. 29-Bulgaria signs armistice and surrenders.  
Nov. 1-Serbs enter and occupy Belgrade.  
Nov. 3-Austrians accept truce terms.

### NAVAL OPERATIONS

#### 1914

Aug. 2-Germans bombard Liepaja, Latvia.  
Aug. 24-Allied warships bombard Kotor on the Adriatic.  
Sept. 28-Battle takes place in Bight of Helgoland.  
Oct. 20-Turkish warships raid Odessa, Sevastopol, Feodosiya, and Novorossisk.

Nov. 1-British squadron is defeated off Coronel, Chile.  
Nov. 2-British declare North Sea a war zone; it is mined.  
Nov. 3-German cruisers bombard Yarmouth and Lowestoft; British bombard outer Dardanelles forts.  
Nov. 18-Russo-Turkish engagement occurs in Black Sea.  
Dec. 8-Vice Adm. Maximilian von Spee's German squadron is destroyed in Battle of the Falkland Islands.  
Dec. 16-German cruisers bombard Scarborough, Hartlepool, and Whitby, England.

#### 1915

Jan. 24-Naval battle takes place in North Sea.  
Feb. 4-Germans declare war zone around Great Britain; effective Feb. 18.  
Feb. 10-United States protests German war zone.  
Feb. 19-British bombard outer Dardanelles forts.  
Feb. 25-Bombardment of Dardanelles forts is renewed.  
March 1-Allies establish undeclared blockade of Central Powers.  
March 4-Major naval attack on Dardanelles begins.  
March 18-Dardanelles attack fails; 3 British and French warships are sunk.  
May 13-First United States note to Germany protests sinking of *Lusitania* on May 7 with loss of 128 American lives.  
Aug. 16-Russo-German action occurs in Gulf of Riga.  
Aug. 20-Russians defeat German landing operations on Gulf of Riga.  
Aug. 21-Germans evacuate Gulf of Riga.  
Aug. 23-Allied fleet bombards Zeebrugge.  
Sept. 6-Allied fleet bombards Ostend.  
Oct. 5-German government promises to avoid attacking passenger vessels.  
Oct. 21-British bombard Bulgarian Aegean coast; United States protests undeclared Allied blockade.

#### 1916

Jan. 18-Bulgarian coast is bombarded by Allies.  
Feb. 6-Austro-Italian action occurs in Adriatic.  
March 25-British destroyers and seaplanes raid zeppelin sheds in Schleswig.

Inside a cramped U boat. Unrestricted submarine warfare was Germany's answer to the Allied naval blockade.

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Curious Britons examine a U boat stranded on a beach in southern England after Germany's surrender in 1918.

- March 31—British warship bombards Smyrna.
- April 18—United States demands assurances that Germans will not sink ships without warning.
- April 20—German auxiliary cruiser and submarine attempt to land arms in Ireland; cruiser is sunk.
- April 25—German squadron and zeppelins raid Lowestoft and Yarmouth.
- May 4—Germany replies to United States that it has ordered submarine commanders to suspend operations against merchant shipping.
- May 31—Battle of Jutland begins between major British and German forces, ends June 1 in drawn battle.
- Oct. 26—German destroyer attack is made in English Channel.
- Nov. 4—Russian fleet bombards Constanța, Romania.
- Nov. 10—Germans shell Baltic port near Tallinn, 6 to 9 destroyers are sunk by Russians.
- Nov. 26—German naval raid is made on Lowestoft.

#### 1917

- Jan. 23—German destroyers engage light British force off Netherlands.
- Jan. 31—Germany announces resumption of unrestricted submarine warfare, effective Feb. 1.
- Feb. 25—German destroyers bombard Broadstairs and Margate, England.
- April 20—Six German destroyers raid Dover; 3 are sunk.
- April 26—German naval raid is made on Ramsgate, England.
- May 10—Eleven German destroyers sally from Zeebrugge, Belgium, but are forced back by British.
- May 12—British air and naval bombardment is made on Zeebrugge.
- Oct. 17—Two British destroyers and 9 escorted ships are sunk off Shetland Islands by 2 German raiders.
- Nov. 17—Light cruiser fight occurs off Helgoland.

#### 1918

- April 22–23—British naval raids are made on Zeebrugge and Ostend, blocking Bruges Canal and Ostend harbor.
- May 9–10—British again raid Ostend.
- July 7—British naval air forces bombard Constantinople.
- July 18—United States cruiser is sunk by torpedo off Fire Island, N.Y.
- Nov. 3—German sailors begin to mutiny.
- Nov. 21—German High Seas Fleet surrenders to British.

#### 1919

- June 21—German crews sink most of the German fleet at Scapa Flow.

### PEACE NEGOTIATIONS

#### 1916

- Feb. 22—Col. Edward M. House, President Woodrow Wilson's representative, and British Foreign Secretary Sir Edward Grey initial agreement on peace terms (never effected).
- Dec. 12—Germany calls for peace negotiations.
- Dec. 18—President Wilson sends note to all belligerents, asking them to inform him confidentially of terms they would accept.
- Dec. 26—In reply, Central Powers tell Wilson that any discussion should be held among belligerents.

#### 1917

- Jan. 10—Allies, in notes to Wilson, offer relatively mild terms.
- Jan. 22—President Wilson calls on both sides to accept "a peace without victory."
- February–May—Prince Sixte of Bourbon undertakes inconclusive peace talks with Austro-Hungarian government.
- July 19—German Reichstag adopts peace resolution.
- Aug. 1—Pope Benedict XV appeals to all belligerents to accept compromise peace.
- Aug. 27—President Wilson stresses moral objections to negotiations with aggressive governments.
- September—Germans refuse to give pope guarantee on restoration of Belgium; negotiations lapse.
- Dec. 3—German-Russian armistice negotiations open at Brest-Litovsk.

#### 1918

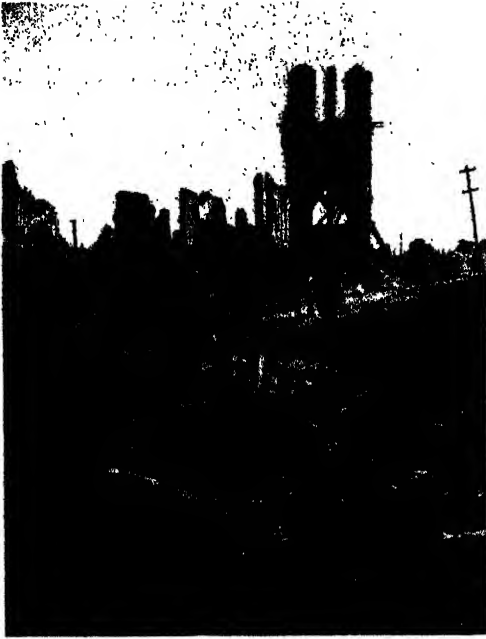
- Jan. 5—British Prime Minister David Lloyd George says Allies are fighting for just and lasting peace.
- Jan. 8—President Wilson presents Fourteen Points.
- Feb. 9—Central Powers and Ukraine sign peace treaty at Brest-Litovsk.
- Feb. 18—German-Russian armistice is terminated after Leon Trotsky refuses to sign peace treaty and unilaterally proclaims peace.
- March 3—Bolsheviks sign Treaty of Brest-Litovsk, ceding much Russian territory, and agree to evacuate Finland.
- Aug. 27—Russia signs treaty in Berlin, renouncing claims to Estonia and Livonia.
- Sept. 14—Austria-Hungary sends note to belligerents, requesting exchange of views; it is rejected.
- Sept. 29—Bulgaria signs armistice; Gen. Erich F. W. Ludendorff asks that armistice be arranged on western front without delay.
- Oct. 4—Austria-Hungary sends note to United States, requesting armistice on basis of Fourteen Points (including autonomy for peoples of empire); Germany, in similar note, also accepts Fourteen Points.
- Oct. 7—Council of Regency in Warsaw proclaims Poland an independent state.
- Oct. 8—President Wilson, replying to German note, questions whether it speaks merely for authorities that had thus far conducted the war.
- Oct. 12—German note states that it speaks for government and people; in reply, President Wilson sets four conditions for armistice.
- Oct. 14—Turks appeal for armistice.
- Oct. 18—United States informs Austria-Hungary that autonomy is no longer a sufficient basis for peace.
- Oct. 19—Serbs, Croats, and Slovenes assert sovereignty over South Slav portions of Dual Monarchy.
- Oct. 20—German note makes further concessions.
- Oct. 23—President Wilson agrees to take up question of German armistice with Allies.
- Oct. 27—Austria-Hungary offers to accept armistice on almost any terms; Germany advises United States that it awaits armistice proposals.
- Oct. 28—Czechs remove imperial officials in Prague.
- Oct. 30—Turks sign armistice, effective Oct. 31.
- Nov. 1—Emperor Charles I releases Hungarians from vows of fealty.

The artillery piece "Calamity Jane" fired the last shot of the war for the United States on Nov. 11, 1918.

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The historic Belgian town of Ypres lies in ruins in 1919. The Allies imposed war reparations on Germany.

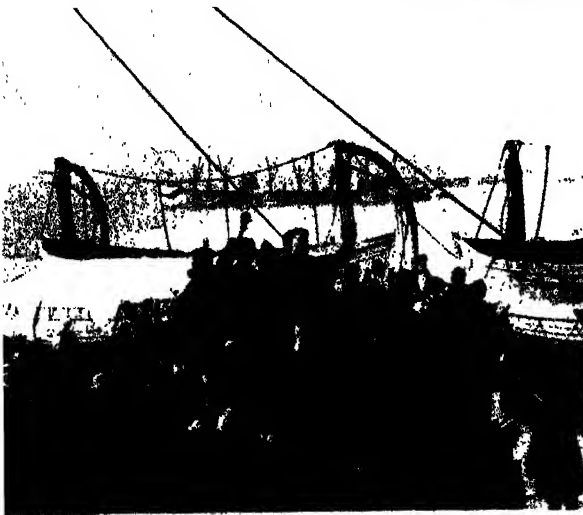
- Nov. 3—Austrians sign armistice at Villa Giusti, effective Nov. 4
- Nov. 5—German government receives President Wilson's fourth note, stating that Allies are prepared to receive German delegates.
- Nov. 9—Chancellor Prince Max of Baden announces that William II and his heirs have renounced German throne; Germany accepts Allies' armistice terms, agreeing to cease hostilities and to evacuate France, Alsace-Lorraine, Belgium, and Luxembourg in 14 days from signature of armistice, and left bank of Rhine and bridgeheads at Mainz, Koblenz, and Cologne in 31 days.
- Nov. 11—Germans sign armistice at Compiègne.

#### 1919

- Jan. 18—Peace conference opens in Paris.
- Feb. 14—Draft Covenant of League of Nations is completed, President Wilson, chief United States delegate, returns to United States to secure support.

American troops home for demobilization greet the Statue of Liberty on arriving in New York in 1919.

UPI/BETTMANN NEWS PHOTOS



- March 4—Thirty-eight United States senators find Covenant unacceptable.
- March 14—President Wilson returns to Paris and begins work to secure revision of Covenant.
- April 24—Italian Premier Vittorio Orlando leaves conference over Fiume issue.
- May 6—Peace conference delegates approve treaty providing for German cessions of territory (Alsace-Lorraine to France, Polish Corridor to Poland, plebiscites elsewhere) and reparations, creation of mandates from former German colonies, occupation of Rhineland, and limitations on German Army.
- May 7—German delegates receive peace terms.
- May 29—Germans present commentary on treaty; proposed changes are rejected by Allies.
- June 28—Allied and German delegates sign treaty of Versailles; United States, Great Britain, and France sign treaty of guaranty.
- Sept. 10—Allied and Austrian delegates sign Treaty of St. Germain-en-Laye; Austria relinquishes claims to territory to be transferred to Italy, Yugoslavia, Czechoslovakia, Romania, and Poland.
- Nov. 19—Treaty of Versailles fails of ratification in United States Senate.
- Nov. 27—Allied and Bulgarian delegates sign Treaty of Neuilly; Yugoslavia and Greece receive territory at Bulgarian expense.

#### 1920

- Jan. 10—Treaty of Versailles is in effect.
- March 19—Treaty of Versailles fails of ratification in United States Senate.
- June 4—Hungarian and Allied delegates sign Treaty of Trianon; Hungary cedes territory to Austria, Czechoslovakia, Romania, and Yugoslavia.
- Aug. 10—Turkish and Allied delegates sign Treaty of Sèvres, because of its harsh terms, it is not ratified by Turks.

#### 1921

- Aug. 24—United States signs a separate treaty of peace with Austria at Vienna.
- Aug. 25—United States signs a separate treaty of peace with Germany at Berlin.
- Aug. 29—United States signs a separate treaty of peace with Hungary at Budapest.

#### 1923

- July 24—Allies and Turkey sign Treaty of Lausanne, Turks regain part of eastern Thrace.

### POSTWAR SETTLEMENTS

#### 1919

- May 14—War breaks out between Greece and Turkey.
- Aug. 9—Treaty places Persia under British protection.

#### 1920

- Jan. 16—League of Nations begins functioning.
- Feb. 2—Treaty of Tartu recognizes independence of Estonia.
- April 25—War breaks out between Poland and Russia, ends Oct. 12 with preliminary Treaty of Riga.
- July 5—Reparations conference opens at Spa (ends July 16), protocol apportioning reparations is signed.
- July 12—Treaty of Moscow recognizes independence of Lithuania.
- July 28—Teschen is divided between Czechoslovakia and Poland.
- Aug. 2—Italy recognizes independence of Albania.
- Aug. 11—Treaty of Riga recognizes independence of Latvia.
- Oct. 10—Plebiscite in Klagenfurt area results in its retention by Austria.
- Oct. 14—Treaty of Tartu recognizes independence of Finland.
- Nov. 12—Under terms of Treaty of Rapallo between Italy and Yugoslavia, Fiume becomes independent city.

#### 1921

- Feb. 21—Reza Khan Pahlavi triumphs in Persia; British 1919 treaty is denounced Feb. 27.
- March 16—Turkish possession of districts of Kars and Ardahan is recognized by USSR.
- March 18—Definitive Treaty of Riga delimits Soviet-Polish frontier.
- March 20—Plebiscite in Upper Silesia results in its partition between Poland and Germany.
- Nov. 12—Washington Conference on disarmament opens, closes Feb. 6, 1922.

#### 1922

- April 16—Treaty of Rapallo is signed by Germany and USSR.
- Oct. 13—War between Greece and Turkey ends.
- Oct. 28—Fascists come to power in Italy.

#### 1923

- Jan. 11—Because of German delay in reparations payments, French and Belgian troops begin to occupy the Ruhr.
- July 24—Straits Convention is signed.

1924

Jan. 27—Yugoslavia agrees to cession of Fiume to Italy.  
 April 9—Dawes Plan on reparations is presented.  
 July 16—London Conference on reparations opens (ends  
 Aug. 16); adopts Dawes Plan.

1925

Aug. 25—French and Belgian troops leave the Ruhr.  
 Dec. 1—Locarno treaties, guaranteeing Franco-German and  
 Belgo-German frontiers against aggression, are signed  
 in London.

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## 18. Costs of the War

War cost are of two kinds—direct and indirect. Direct costs embrace all expenditures made by belligerents in carrying on hostilities. Indirect costs include the economic losses resulting from deaths attributable directly or indirectly to the war, the value of property damaged or destroyed, the loss of production arising from the transfer of civilians to military pursuits, expenditures from war relief work, the cost of war to neutral nations, and the like. The direct costs of World War I, based on the most reliable statistics, were \$186,333,637,000; the indirect costs have been estimated at \$151,646,942,560, making the total war bill \$337,980,579,560. It has been possible to appraise the direct costs fairly accurately, but the indirect costs can only be estimated, for there is no unit of measurement by which they may be definitely fixed. Notwithstanding the many figures purporting to show how much money was spent to carry on the war, the fact is that it was fought mainly on credit, since the gold available at the outbreak of hostilities was not sufficient to have kept it going for more than 40 or 50 days. During the first three years of the war the average daily cost was \$123 million, and in 1918 it rose to \$225 million.

**Direct War Costs.**—Table 1 shows the net direct costs of the war to the belligerents. It allows credit for territory, shipping, and other material gains by the victors, and assumes full repayment of loans and collection of indemnities.

Table 1—DIRECT COSTS OF THE WAR

Countries	Cost
<b>Allied and Associated Powers:</b>	
United States .....	\$ 22,625,253,000
Great Britain .....	35,334,012,000
<b>British Dominions and Colonies:</b>	
Canada .....	1,665,576,000
Australia .....	1,423,208,000
New Zealand .....	378,750,000
India .....	601,279,000
Union of South Africa .....	300,000,000
Colonies .....	125,000,000
France .....	24,265,583,000
Russia .....	22,593,950,000
Italy .....	12,413,998,000
Belgium .....	1,154,468,000
Romania .....	1,600,000,000
Japan .....	40,000,000
Serbia .....	399,400,000
Greece .....	270,000,000
Other Allied countries .....	500,000,000
Total .....	\$125,690,477,000
<b>Central Powers:</b>	
Germany .....	\$37,775,000,000
Austria-Hungary .....	20,622,960,000
Turkey .....	1,430,000,000
Bulgaria .....	815,200,000
Total .....	\$ 60,643,160,000
<b>Grand Total .....</b>	<b>\$186,333,637,000</b>

**Indirect War Costs.—Loss of Human Life.**—The average social value of an individual in the six leading belligerents at the time of the war has been estimated as follows: United States, \$4,720; Great Britain, \$4,140; Germany, \$3,380; France, \$2,900; Austria-Hungary, \$2,750; and Russia, \$2,020. Table 2 has been developed on the basis of these values and appropriate assumptions for the other belligerents.

Table 2—CAPITALIZED VALUE OF LOSS OF LIFE

Countries	Lives Lost <sup>1</sup>	Value
United States .....	109,740	\$ 517,972,800
Great Britain .....	839,904	3,477,202,560
Germany .....	1,997,365	6,751,093,700
France .....	1,654,550	4,798,195,000
Austria-Hungary .....	1,132,500	3,114,375,000
Russia .....	4,012,064	8,104,369,280
Belgium .....	272,000	788,800,000
Italy .....	1,180,660	2,397,053,200
Serbia <sup>2</sup> .....	757,343	1,529,832,860
Romania .....	397,117	802,176,340
Greece .....	37,500	75,750,000
Portugal .....	4,100	8,282,000
Japan .....	301	608,020
Turkey .....	488,789	987,353,780
Bulgaria .....	106,637	215,406,740
Total, armed forces .....	12,990,570	\$33,568,471,280
Estimated loss resulting from civilian deaths <sup>3</sup> .....		33,568,471,280
Total valuation of lives lost .....		\$67,136,942,560

<sup>1</sup>Assumes that approximately half of those listed as missing or prisoners of war actually died. <sup>2</sup>The figure of 757,343 lives lost by Serbia in this compilation is undoubtedly in error, for Serbia mobilized a total of only 707,343 men; a more valid figure would be 121,500. <sup>3</sup>Such deaths are supposed to equal the number of those in the armed forces.

**Property Losses.**—Estimating losses caused by destruction and damage to property in war is an exceedingly difficult task. One estimate, used in Tables 3 and 4, places total property losses in World War I at \$36,760 million, of which \$29,960 million was sustained on land and \$6,800 million at sea. The merchant vessels sunk, aggregating 15,398,392 gross tons, represent a loss of \$3,000 million, and their cargoes were valued at \$3,800 million.

Table 3—PROPERTY LOSSES ON LAND

Countries or areas	Value
Belgium .....	\$ 7,000,000,000
France .....	10,000,000,000
Russia (except for the Ukraine) .....	1,250,000,000
Poland .....	1,500,000,000
Serbia, Albania, and Montenegro .....	2,000,000,000
East Prussia, Austria, and the Ukraine .....	1,000,000,000
Italy .....	2,710,000,000
Romania .....	1,000,000,000
British Empire .....	1,750,000,000
Germany (except for East Prussia) .....	1,750,000,000
Total .....	\$29,960,000,000

**Loss in Production.**—One of the major indirect costs of World War I was the loss in production arising from the withdrawal of millions of civilians from commercial pursuits for service in the armed forces. In 1917 there were 38 million men under arms, and it is estimated that an average of 20 million men served in the armed forces during each of the four and one-half years of the war. If we ascribe to these men an average earning capacity of \$500 annually, the estimated loss in production is \$45 billion.

**War Relief Costs.**—The relief work made necessary by the war is estimated to have cost \$1 billion (Table 5), all of which was raised by voluntary subscriptions.

Table 4—LOSSES OF SEAGOING MERCHANT VESSELS  
(In gross tons)

Countries of registry	Lost by enemy action	Lost by marine risk
<b>Allies and Neutrals:</b>		
United States .....	394,658	430,759
Great Britain .....	7,756,659	1,143,000
Norway .....	1,177,001	
Italy .....	846,333	
France .....	888,783	
Denmark .....	240,860	
Sweden .....	200,829	
Greece .....	345,516	
Russia .....	182,933	
Netherlands .....	203,190	
Spain .....	167,865	710,285
Portugal .....	93,136	
Belgium .....	83,819	
Japan .....	120,176	
Brazil .....	25,464	
Argentina .....	4,275	
Uruguay .....	6,027	
Peru .....	1,419	
Romania .....	3,973	
Persia (Iran) .....	758	
<b>Total .....</b>	<b>12,743,674</b>	<b>2,284,044</b>
<b>Central Powers:</b>		
Germany .....	187,340	86,265
Austria-Hungary .....	15,166	20,433
Turkey .....	61,470	...
<b>Total .....</b>	<b>263,976</b>	<b>106,698</b>
<b>Total, all countries ..</b>	<b>13,007,650</b>	<b>2,390,742</b>
<b>Total, all sinkings ..</b>		<b>15,398,392</b>

Table 5—WAR RELIEF EXPENDITURES

Countries	Contributions
United States .....	\$ 625,015,028
<b>British Empire:</b>	
Great Britain .....	\$87,112,000
Canada .....	91,750,000
New Zealand .....	17,585,000
Australia .....	36,000,000
South Africa .....	10,000,000
Newfoundland .....	3,000,000
India .....	3,600,000
	249,047,000
<b>Other countries .....</b>	<b>125,937,972</b>
<b>Total .....</b>	<b>\$1,000,000,000</b>

**Cost of War to Neutral Nations.**—As shown in Table 6, the estimated cost of World War I to the neutral nations is \$1,750 million, which represents the sums that they expended in guarding their frontiers and in otherwise maintaining their neutrality.

Table 6—COST OF WAR TO NEUTRAL NATIONS

Countries	Expenditures
Netherlands .....	\$ 672,000,000
Switzerland .....	250,000,000
Sweden .....	429,800,000
Norway .....	130,000,000
Denmark .....	90,000,000
Other neutral nations .....	178,200,000
<b>Total .....</b>	<b>\$1,750,000,000</b>

**Total Costs.**—In summary, the total of the direct costs and the various types of indirect costs of World War I is as follows:

Value of lives lost .....	\$ 67,136,942,560
Value of property lost .....	36,760,000,000
Loss in production .....	45,000,000,000
War relief costs .....	1,000,000,000
Cost to neutral nations .....	1,750,000,000
<b>Total, indirect costs ..</b>	<b>\$151,646,942,560</b>
<b>Direct costs .....</b>	<b>186,333,637,000</b>
<b>Grand total .....</b>	<b>\$337,980,579,560</b>

**War Loans.**—During the war the United States and Great Britain made substantial loans to their allies, as shown in Tables 7 and 8. In addition, France advanced \$1,547,200,000 to her allies, of which Belgium received \$434,125,090; and Japan loaned \$333,000,000 to Russia.

Table 7—ADVANCES TO ALLIES BY THE UNITED STATES

Countries	Loans
Great Britain .....	\$4,316,000,000
France .....	2,852,000,000
Italy .....	1,591,000,000
Russia .....	187,000,000
Belgium .....	341,000,000
Serbia .....	27,000,000
Czechoslovakia .....	50,000,000
Greece .....	43,000,000
Romania .....	30,000,000
Cuba .....	10,000,000
Liberia .....	5,000,000
<b>Total .....</b>	<b>\$9,452,000,000</b>

Table 8—ADVANCES TO ALLIES BY GREAT BRITAIN

Countries	Loans
France .....	\$2,170,000,000
Italy .....	2,065,000,000
Russia .....	2,840,000,000
Belgium .....	435,000,000
Serbia .....	90,000,000
Other Allied countries .....	240,000,000
British Dominions .....	855,000,000
<b>Total .....</b>	<b>\$8,695,000,000</b>

For details concerning the statistics given in this article, as well as for the derivation of the tabulations, consult Ernest L. Bogart, *Direct and Indirect Costs of the Great World War*, 2d ed. (1920), a scholarly work published by the Carnegie Endowment for International Peace, from which these data have been taken.

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## 19. War Casualties

The number of casualties in World War I exceeded by far those of any other war before World War II, in which almost 17 million men of the armed forces perished. Civilian deaths from military action, massacre, starvation, and exposure in the war between 1914 and 1918 are estimated at 12,618,000. Tables 1, 2, and 3 include only casualties in the armed forces.

Table 1—AMERICAN ARMY CASUALTIES  
IN WORLD WAR I

Cause of death	Overseas	Domestic	Total
Killed in action .....	36,926	5	36,931
Died of wounds received			
in action .....	13,628	45	13,673
Died of disease .....	23,853	38,815	62,668
Died of accident .....	2,557	1,946	4,503
Drowned .....	328	399	727
Committed suicide .....	296	671	967
Murdered .....	159	159	318
Executed .....	11	25	36
Died of other causes .....	131	190	321
<b>Total .....</b>	<b>77,889</b>	<b>42,253</b>	<b>120,144</b>
<b>Total wounded .....</b>	<b>198,059</b>		<b>198,059</b>
<b>Grand total, died and wounded .....</b>	<b>275,948</b>	<b>42,253</b>	<b>318,203</b>

Table 2—ARMIES MOBILIZED AND CASUALTIES IN WORLD WAR I<sup>1</sup>

Countries	Total mobilized forces	Killed and died	Wounded casualties	Prisoners and missing	Total casualties	Percentage of mobilized forces in casualties
<b>Allied and Associated Powers:</b>						
Russia .....	12,000,000	1,700,000	4,950,000	2,500,000	9,150,000	76.3
France .....	8,410,000	1,357,800	4,266,000	537,000	6,160,800	73.3
British Empire .....	8,904,467	908,371	2,090,212	191,652	3,190,235	35.8
Italy .....	5,615,000	650,000	947,000	600,000	2,197,000	39.1
United States .....	4,355,000	126,000	234,300	4,500	364,800	8.2
Japan .....	800,000	300	907	3	1,210	0.2
Romania .....	750,000	335,706	120,000	80,000	535,706	71.4
Serbia .....	707,343	45,000	133,148	152,958	331,106	46.8
Belgium .....	267,000	13,716	44,686	34,659	93,061	34.9
Greece .....	230,000	5,000	21,000	1,000	27,000	11.7
Portugal .....	100,000	7,222	13,751	12,318	33,291	33.3
Montenegro .....	50,000	3,000	10,000	7,000	20,000	40.0
<b>Total</b>	<b>42,188,810</b>	<b>5,152,115</b>	<b>12,831,004</b>	<b>4,121,090</b>	<b>22,104,209</b>	<b>52.3</b>
<b>Central Powers:</b>						
Germany .....	11,000,000	1,773,700	4,216,058	1,152,800	7,142,558	64.9
Austria-Hungary .....	7,800,000	1,200,000	3,620,000	2,200,000	7,020,000	90.0
Turkey .....	2,850,000	325,000	400,000	250,000	975,000	34.2
Bulgaria .....	1,200,000	87,500	152,390	27,029	266,919	22.2
<b>Total</b>	<b>22,850,000</b>	<b>3,386,200</b>	<b>8,388,448</b>	<b>3,629,829</b>	<b>15,404,477</b>	<b>67.4</b>
<b>Grand total</b>	<b>65,038,810</b>	<b>8,538,315</b>	<b>21,219,452</b>	<b>7,750,919</b>	<b>37,508,686</b>	<b>57.6</b>

As reported by the United States War Department in February 1924.

Table 3—AMERICAN WAR CASUALTIES BY STATES AND TERRITORIES

State or territory	Total casualties	Killed or died
Alabama .....	5,160	1,251
Alaska .....	15	6
Arizona .....	557	150
Arkansas .....	2,658	883
California .....	6,650	1,747
Canal Zone .....	3	2
Colorado .....	1,759	537
Connecticut .....	6,625	1,265
Delaware .....	303	87
District of Columbia .....	773	202
Florida .....	1,171	467
Georgia .....	4,425	1,530
Hawaii .....	13	4
Idaho .....	1,351	409
Illinois .....	18,264	4,260
Indiana .....	5,766	1,510
Iowa .....	7,311	2,161
Kansas .....	5,182	1,270
Kentucky .....	5,380	1,436
Louisiana .....	2,160	823
Maine .....	2,090	518
Maryland .....	3,812	975
Massachusetts .....	13,505	2,955
Michigan .....	10,369	2,751
Minnesota .....	7,323	2,133
Mississippi .....	2,303	904
Missouri .....	10,385	2,562
Montana .....	3,443	934
Nebraska .....	3,041	855
Nevada .....	250	71
New Hampshire .....	1,535	358
New Jersey .....	10,166	2,367
New Mexico .....	860	228
New York .....	40,222	9,196
North Carolina .....	5,799	1,610
North Dakota .....	2,560	700
Ohio .....	16,007	4,082
Oklahoma .....	6,358	1,471
Oregon .....	1,577	512
Pennsylvania .....	35,042	7,898
Philippines .....	7	3
Puerto Rico .....	11	1
Rhode Island .....	1,562	355
South Carolina .....	3,919	1,138
South Dakota .....	1,867	554
Tennessee .....	6,190	1,836
Texas .....	10,133	2,722
Utah .....	1,006	302
Vermont .....	1,170	300
Virginia .....	6,130	1,635
Washington .....	3,070	877
West Virginia .....	4,018	1,063
Wisconsin .....	9,813	2,649
Wyoming .....	676	233

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## WORLD WAR II

As World War II opens with the Nazi attack on Poland in September 1939, German troops advance along a deeply rutted, sandy road toward Warsaw.

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**WORLD WAR II**, the name commonly given to the global conflict of 1939–1945. It was the greatest and most destructive war in history. Whereas military operations in World War I were conducted primarily on the European continent, World War II included gigantic struggles not only in Europe but in Asia, Africa, and the far-flung islands of the Pacific as well. More than 17 million members of the armed forces of the various belligerents perished during the conflict. Its conduct strained the economic capabilities of the major nations and left many countries on the edge of collapse.

The events leading to World War II, its military operations, diplomacy, statistical data, and results, are discussed under the following headings:

- |   |   |
|---|---|
| 1. The War in Brief                             | 10. War in the Central and Northern Pacific |
| 2. Between World Wars                           | 11. War in Eastern Asia                     |
| 3. Early Campaigns                              | 12. Developments in Naval Warfare           |
| 4. Fall of the Low Countries and France         | 13. Developments in Air Warfare             |
| 5. Recovery of France and Advance into Germany  | 14. Diplomatic History                      |
| 6. German Invasion of the USSR                  | 15. Pastwar World                           |
| 7. Balkan Campaigns                             | 16. Chronology                              |
| 8. Mediterranean Operations                     | 17. Costs, Casualties, and Other Data       |
| 9. War in the Southern and Southwestern Pacific | 18. Bibliography                            |

### 1. The War in Brief

**Events Leading to War.**—At the end of World War I the victorious nations formed the League of Nations for the purpose of airing international disputes, and of mobilizing its members for a collective effort to keep the peace in the event of aggression by any nation against another or of a breach of the peace treaties. The United States, imbued with isolationism, did not become a member. The League failed in its first test. In 1931 the Japanese, using as an excuse the explosion of a small bomb under a section of track of the South Manchuria Railroad (over which they had virtual control), initiated military operations designed to conquer all of Manchuria. After receiving the report of its commission of inquiry, the League adopted a resolution in 1933 calling on the Japanese to withdraw. Thereupon, Japan resigned from the League. Meanwhile, Manchuria had

been overrun and transformed into a Japanese puppet state under the name of Manchukuo. Beset by friction and dissension among its members, the League took no further action.

In 1933 also, Adolf Hitler came to power as dictator of Germany and began to rearm the country in contravention of the provisions of the Treaty of Versailles. He denounced the provisions of that treaty that limited German armament and in 1935 reinstituted compulsory military service. That year the Italian dictator Benito Mussolini began his long-contemplated invasion of Ethiopia, which he desired as an economic colony. The League voted minor sanctions against Italy, but these had slight practical effect. British and French efforts to effect a compromise settlement failed, and Ethiopia was completely occupied by the Italians in 1936.

Alarmed by German rearmament, France sought an alliance with the USSR. Under the pretext that this endangered Germany, Hitler remilitarized the Rhineland in 1936. It was a dangerous venture, for Britain and France could have overwhelmed Germany, but, resolved to keep the peace, they took no action. Emboldened by this success, Hitler intensified his campaign for *Lebensraum* (space for living) for the German people. He forcibly annexed Austria in March 1938, and then, charging abuse of German minorities, threatened Czechoslovakia. In September, as Hitler increased his demands on the Czechs and war seemed imminent, the British and French arranged a conference with Hitler and Mussolini. At the Munich Conference they agreed to German occupation of the Sudetenland, Hitler's asserted last claim, in the hope of maintaining peace. This hope was short lived, for in March 1939, Hitler took over the rest of Czechoslovakia and seized the former German port of Memel (Klaipėda) from Lithuania. There followed demands on Poland with regard to Danzig (Gdansk) and the Polish Corridor. The Poles remained adamant, and it became clear to Hitler that he could attain his objectives only by force. After surprising the world with the announcement of a nonaggression pact with his sworn foe, the Soviet Union, he sent his armies across the Polish border on Sept. 1, 1939. Britain and France, pledged to support





U.S. Navy

Above: Installations at Wheeler Field burn, viewed from a Japanese plane attacking Pearl Harbor on Dec. 7, 1941.

Poland in the event of aggression, declared war on Germany two days later.

As the Germans ravaged Poland, the Russians moved into the eastern part of the country and began the process that was to lead to the absorption in 1940 of Latvia, Estonia, and Lithuania. They also made demands on Finland. The recalcitrant Finns were subdued in the Winter War of 1939-1940, but only after dealing the Russians several humiliating military reverses.

Meanwhile, Japan had undertaken military operations for the subjugation of China proper, and was making preparations for the expansion of its empire into Southeast Asia and the rich island groups of the Southwest Pacific. Mussolini watched the progress of his fellow dictator, Hitler, while preparing to join in the war at a propitious moment.

**Military Course of the War.**—The bitter struggles and the enormous casualties suffered by Great Britain and France in World War I had engendered in their military leaders a defensive attitude with a reliance on such permanent fortifications as the Maginot Line and on blockade as means of subduing a resurgent Germany. Placing their faith in the impotent League of Nations, both countries neglected the development of armaments and allowed those they possessed and their armed forces to deteriorate. The Germans, on the other hand, smarting under their failure in World War I to capitalize on initial breakthroughs of the Allied lines because of lack of sustained power, developed fast, hard-hitting tank-airplane forces and the strategy of the blitzkrieg (lightning war). Since they had been disarmed by the Allies, they were unencumbered by obsolescent armaments and could equip their forces with the most modern weapons. As a result, initial German operations met with surprisingly rapid success.

In less than a month, Poland had been conquered. There followed an inactive period (dubbed the Phony War) that lasted until April 1940. Then, despite Allied intervention, the Germans quickly seized Denmark and Norway. In May the blitzkrieg struck the western front in all its fury. Within six weeks the British had been driven from the Continent, and the French had been forced to surrender. The speed of the ad-

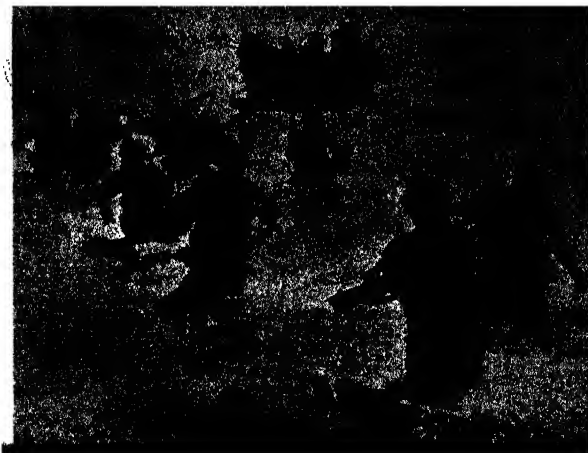


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Above: Defeated German soldiers are captured by Soviet forces in November 1942 at the Battle of Stalingrad.

Below: American soldiers go ashore in Normandy as Allies begin reconquest of France in June 1944.

Agence France Presse from Pictorial



vance also surprised Hitler, who was not ready to follow his success with an invasion of the British Isles. The Luftwaffe, called upon to soften the islands and gain air superiority while preparations were made for invasion, received a stunning defeat at the hands of the small but highly competent and brave Royal Air Force. Frustrated in the west, Hitler turned against the USSR in June 1941. In a series of brilliant military maneuvers in which several million Russians were captured, he reached the gates of Moscow in December, only to be stopped by bad weather and Russian reinforcements rushed to defend the city.

Meanwhile, Mussolini sought to realize his dream of an Italian Mediterranean empire. In the late summer and fall of 1940 he launched an offensive from Libya against the British in Egypt and an invasion of Greece from Albania (which he had occupied in 1939). Both enterprises eventually proved disastrous for the Italians, and German forces were sent to their rescue. Greece fell to the Germans, but they met stiff British opposition in Africa. In December 1941, Japan thought the time ripe to extend her empire into a Greater East Asia Coprosperity Sphere (see Map 35), which it did very rapidly against meager opposition. It was the Japanese plan to fortify this area so strongly as to withstand American counterattacks and eventually gain a negotiated peace based on the status quo. The attacks on Pearl Harbor and the Philippines brought the United States into the war and greatly altered the balance of power in favor of the Allies.

The year 1942 saw the turn of the tide for the Allies. In June, Japanese naval airpower was decimated by the United States Navy in the Battle of Midway. Having been repulsed at Moscow, Hitler turned to the Caucasus, but the Germans were severely defeated and turned back at Stalingrad (now Volgograd) by the Russians in the closing months of the year. At the same time the British dealt the Germans and Italians a defeat at El Alamein that sent them reeling in retreat westward along the African Mediterranean coast. In Tunisia they encountered newly landed British and American forces and were expelled from Africa in May 1943.

The Allies now had the initiative and, with the vast production facilities of the United States in full operation, took the offensive on all fronts. Resistance was bitter, and progress slow though inexorable. From bases in Africa the Allies invaded and captured Sicily in July–August 1943. In September, Italy was forced out of the war. British, American, and French forces began a methodical and relentless advance up the Italian Peninsula against the Germans, who had been rushed in to defend it. After Stalingrad the Russians, in a series of alternating offensives, gradually forced the Germans back with heavy losses, until by late April 1945 they were approaching Berlin.

Following a massive buildup of troops, air and naval power, and equipment in the British Isles, American, British, and French troops landed on the Normandy coast of France in June 1944 and pressed the Germans back to the West Wall. There, in December, the Germans launched a final counterattack, which failed. Aided by troops landed in southern France from Italy, the Allies forced the Germans back across the Rhine River

and deep into Germany. Assailed on all sides, and their major cities devastated by aerial bombardment, the Germans surrendered on May 7, 1945.

Because of a lack of resources, Allied strategy had envisioned the prior defeat of Germany while remaining on the defensive against the Japanese. Only after victory in Europe would the full Allied power be applied to Japan. American industrial production increased so rapidly, however, that limited offensives could be initiated against the Japanese as early as August 1942. Thereafter, a persistent two-pronged offensive across the Central Pacific and along the Solomon Islands–New Guinea axis steadily pushed the Japanese back. By the fall of 1944, American forces were landing in the Philippines, and they regained the islands the next spring. Then the island of Okinawa, at the threshold of Japan proper, was captured, and preparations were begun for the invasion of the home islands. Meanwhile, the Japanese position in Asia progressively deteriorated. By the summer of 1945, with its navy and air force virtually destroyed, its cities at the mercy of American aircraft, and cut off from sources of supply of much-needed raw materials, the Japanese foresaw doom. The dropping of two atomic bombs on Japanese cities and the Soviet invasion of Manchuria hastened their decision to capitulate, which they did on August 14.

**Diplomatic History of the War and Postwar Period.**—The League of Nations having failed through inertia and internal discord to prevent war, the major powers aligned themselves in rival groups. In September 1940, Germany, Italy, and Japan signed the Tripartite Pact in Berlin, formalizing the Axis coalition. Hitler's invasion forced the Russians into the Franco-British camp. As the war progressed, the United States departed from its policy of strict neutrality and rendered greater and greater aid short of war to the beleaguered Allies. Blocked in negotiations with the United States from furthering its aims of expansion, Japan attacked the American base at Pearl Harbor in December 1941 and forced the United States into the war.

Meanwhile, in August 1941, Franklin D. Roosevelt and Winston Churchill met on shipboard off Newfoundland and subsequently issued the Atlantic Charter, in which they subscribed to certain general principles for achieving peace. The charter forbade territorial changes contrary to the wishes of the inhabitants; recognized the right of people to choose their own forms of government; promised greater freedom of trade and of the seas; and supported international cooperation to improve conditions of labor and social security. Armaments were to be reduced, and a permanent system of general security was to be created. The aggressor nations were to be disarmed. On Jan. 1, 1942, the United States, Great Britain, France, the USSR, China, and 21 other countries signed in Washington the Declaration by United Nations, pledging mutual assistance and promising not to enter into separate armistice or peace negotiations with the Axis powers. The member nations also subscribed to the Atlantic Charter's purposes and principles.

At the Casablanca Conference in January 1943, Roosevelt and Churchill—most probably to allay Joseph Stalin's suspicions of the loyalty of his allies—proclaimed a policy of unconditional surrender for Germany, Italy, and Japan as the only means of maintaining the peace. This policy may have prolonged the war, but it solidified the

<sup>1</sup> The term "British," as applied to military forces, includes where appropriate other Commonwealth forces—Canadian, Australian, New Zealand, South African, and Indian—which performed outstandingly during the war.

Allied nations and may have forestalled Soviet efforts toward a separate peace with Germany in 1943.

At the Teheran Conference in late 1943, Roosevelt, Churchill, and Stalin agreed on broad principles of operation for an international organization to mediate differences between nations and maintain peace. At Dumbarton Oaks in Washington in the fall of 1944 details were worked out, and it was decided to call the new organization the United Nations. The San Francisco Conference convened on April 25, 1945, to organize the United Nations; its charter was adopted unanimously on June 26.

War's end found the United States and the USSR the two greatest powers in the world. By the time of the signing of the Axis satellite treaties early in 1947, the two countries were drawing apart. Friction over the treaties with Austria, Germany, and Japan and Soviet aggressive designs in eastern Europe brought increasing tension, and by the end of 1948 their relationship could be considered one of cold war. In 1950 armed conflict arose in Korea between Soviet-backed Communist forces and United Nations forces led by the United States. The cold war between the East and West continued thereafter, with the Communists striving for world domination through subversion and infiltration, and the West seeking to frustrate their designs.

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## 2. Between World Wars

After World War I representatives of the victorious powers met in Paris to devise a peace settlement that would protect future generations from another such conflict. All agreed that a new framework or system was needed in international relations. Each power, however, had different views as to what that framework should be. From their compromises emerged treaties of peace, the chief of which was that with defeated Germany signed at Versailles on June 28, 1919. Based on the assumption that Germany and her allies had been the disturbers of the status quo, these treaties attempted to place curbs on their future actions. Articles 160, 180, 181, and 198 of the Treaty of Versailles, for example, forbade Germany to have an army of more than 100,000 men, a fleet of more than 36 combatant vessels, or any submarines or military or naval aircraft, or to maintain fortifications or military installations within 50 kilometers of the east bank of the Rhine. In addition, the defeated states were to be required to pay large sums as reparations for damages that the victors had suffered during the war.

But these punitive clauses were not supposed to form the keystone of the new system. That was to be the League of Nations, the organization whose Covenant was incorporated in the Treaty of Versailles and in the treaties of St. Germain-en-Laye with Austria, of Neuilly with Bulgaria, of Trianon with Hungary, and of Sévres with Turkey (superseded by the Treaty of Lausanne). With the victorious nations as the original members of the League and with provision for the admission of other states, including eventually even the Germans and those who had been on their side, its Assembly was expected to provide a forum for the airing of all international

issues. In the event of any aggression by one state against another or any breach of one of the peace treaties, its Council was to mobilize all members, large and small, for a collective effort to keep the peace.

Neither the punitive clauses of the treaties nor the Covenant worked out quite as their authors had hoped. Although the Germans complied with most of the restrictions imposed on them, they recovered rapidly in relative strength. At Rapallo on April 16, 1922, they signed with the other outcast of Europe, the Bolshevik USSR, a treaty providing for mutual renunciation of claims and future economic cooperation. The victors meanwhile fell out. The British and French disagreed about Middle Eastern issues and about the amount of reparations that should be exacted from Germany. So sharp did their exchanges become that by 1923 it was commonly assumed that if there were another war it might well be one between Britain and France. As for the United States, its Senate declined to ratify the Treaty of Versailles; it took no part in the League and withdrew into self-imposed isolation, denying that it bore any responsibility for the maintenance of peace in Europe.

By the latter part of the 1920's, the guarantees of peace were somewhat different from those that had been envisioned in 1919. The articles of the Treaty of Versailles designed to keep Germany in check were supplemented by defensive alliances between France and certain of Germany's eastern neighbors: Poland (Feb. 19, 1921) and the nations of the Little Entente, Czechoslovakia (Jan. 25, 1924), Rumania (June 10, 1926), and Yugoslavia (Nov. 11, 1927). At a conference held in Locarno on Oct. 5-16, 1925, the German government entered into treaties (signed in London on December 1) with France, Britain, Belgium, and Italy, guaranteeing the existing Franco-Belgian-German frontiers. On Sept. 8, 1926, Germany was admitted to the League. The peace thus rested on three sets of undertakings: the pledges of mutual support between France and her allies, the guarantees exchanged at Locarno, and the promises of collective action made by those nations that subscribed to the Covenant. Events of 1931 and later years were to prove all these safeguards frail.

See also LOCARNO, PACT OF; VERSAILLES, TREATY OF; WORLD WAR I-16. *The Postwar World*.

## BREAKDOWN OF THE VERSAILLES SYSTEM

**Manchurian Incident.**—On Sept. 18, 1931, a small bomb exploded underneath a section of track on the South Manchuria Railroad. The Japanese Army, which under long-standing agreements policed the railroad, used this incident as a pretext for launching operations aimed at conquering all of Manchuria for Japan. The Chinese government, which had nominal sovereignty over the area, protested to the League of Nations. Some supporters of the principle of collective security saw an opportunity for the League to prove that it was capable of stopping an aggressor. The majority of member governments, however, did not, feeling that the fate of Manchuria was not of vital concern to them, or that the Japanese had some justice on their side, or that action by the League might harm moderates in Tokyo who were trying to hold the army in check. In the upshot the Council passed two resolutions, one on September 30 and the other on October 23,

urging the Japanese to cease their military operations and enter into direct negotiations with China and appointing a special commission to investigate the situation and help the parties reach a settlement.

Paying little attention to the League's advice, the Japanese continued their operations. When the Chinese organized a boycott of Japanese goods, they went even further. Reinforcing the garrison which they already maintained at Shanghai, in January 1932 they seized control of that city. By May they had been persuaded by League mediators to reach a truce agreement with the Chinese in Shanghai, from which their forces were gradually withdrawn. In the meantime, however, they had convened in Manchuria a rump assembly and had it proclaim the independence of the region, now to be called Manchukuo, on February 18. The new state, which came into existence officially on March 1, signed with Japan on September 15 a treaty making it a virtual ward of that country.

The first Western nation to show umbrage over these events was the United States. Despite its isolationism it had a long tradition of interest in the Far East. When the League Council convened to hear the Chinese protests, the American government sent an official observer to Geneva. The view in Washington at that time was that Western powers ought not to do anything that might aggravate the political situation in Tokyo, but Secretary of State Henry L. Stimson subsequently became convinced that there ought to be some general assertion of opposition to Japanese aggression. Although himself in favor of threatening Japan with collective sanctions, he had to reckon with the stubborn pacifism of President Herbert Hoover. The most that he could do was, on Jan. 7, 1932, to dispatch a formal note to Tokyo, declaring that the United States would not recognize Japanese sovereignty over territory acquired by force. This formulation was termed variously the Stimson Doctrine and the Hoover Doctrine. Although one of the arguments used by opponents of League action had been the fact that the United States was not a member of the organization, the American initiative attracted little immediate support. When asked by Stimson to make a similar declaration, the British government declined. Not until after the evacuation of Shanghai did British statesmen even suggest that the League might adopt the Stimson Doctrine as its own.

The sessions of the League Assembly in the fall and winter of 1932-1933 were devoted largely to the Manchurian issue. The commission of inquiry, headed by the 2d earl of Lytton, made its report, stating that while the Japanese had possessed some grievances their action had been excessive, that the establishment of an independent Manchukuo had not been in accordance with the wishes of the people, and that Japanese forces ought to return the rail lines, restore the *status quo ante bellum*, and negotiate a new understanding about Manchuria with the Chinese. After prolonged debate the Assembly adopted on Feb. 24, 1933, a resolution refusing to recognize Manchukuo and calling on the Japanese to retire. The only result was to bring on March 27 the resignation (effective in two years' time) of Japan from the League of Nations. The system of collective security created by the Paris peace treaties had been tested and been found wanting.

**Economic Issues.**—In the meantime, a severe economic depression had developed. A crash of the New York stock market in October 1929 had been followed by a rapid decline in American production, employment, and foreign commerce. The repercussions were soon felt in all countries that traded with the United States and also in those where American funds were invested. So far flung was the network of American commercial and financial relationships that by 1931 people were speaking of a world depression.

It had soon become clear that most European governments would be unable to continue making payments on World War I debts. Ever since the early 1920's, British statesmen had been urging that the United States forgive all or part of what was owed by her wartime allies, proposing that they in turn remit some or all of the payments due them from Germany as reparations. The American government had rejected this proposal, but in 1931, faced with the depression, President Hoover relented and arranged for a one-year moratorium on both debt and reparation payments. Seeking reelection in 1932, he dared not repeat the experiment. Some of the debtor states were forced to default. In the end all but Finland did so, and the result was not only to embarrass the governments involved but also to strengthen isolationist feeling in the United States.

Eventually almost all the affected states sought solutions for their economic problems in independent, nationalistic action. Seeking a commercial and financial advantage over other countries, the British abandoned the gold standard and devalued the pound in 1931. Through agreements reached in a conference held at Ottawa on July 21-Aug. 21, 1932, they also abandoned the tradition of free trade and established preferential tariffs for the Commonwealth. The American government deserted the gold standard in 1933 and in the same year caused the failure of the London Monetary and Economic Conference by declaring that it would not join in an agreement to stabilize exchange rates. Fascist Italy adopted more drastic measures, instituting rigid economic controls and creating jobs by enlarging the armed forces and accelerating weapons production. Germany, which was ruled after Jan. 30, 1933, by the National Socialist (Nazi) dictator Adolf Hitler, went even farther in the same directions. The community of nations envisioned in the Paris peace treaties dissolved into an anarchy of jealous states seeking national advantage and national self-sufficiency.

See also REPARATIONS.

**Rise of Hitler.**—By far the most ominous event of these depression years was the emergence of Hitler in Germany. A psychopathic personality, he rejected all conventional moral standards. In his book *Mein Kampf* (2 vols., 1925-1927, q.v.) and in later speeches he had disclosed his abhorrence of such concepts as equality and majority rule, his hatred of Jews, his belief that "Aryans" were a "master race" entitled to dominate others, and his conviction that the state had a right to use any means to achieve its ends. He had also set forth his views on foreign policy. He held that Germany should expand in order to bring within it all Europeans of German nationality. Saying also that the German people needed *Lebensraum* (space for living), he indicated that it was to be found in eastern Europe. At the same time he declared that Germany had to have "a final active reckoning with France."

His words showed that he desired German hegemony over Europe and would have no scruples about the methods he used.

The other nations of Europe viewed him with alarm but also with uncertainty. Few could believe that he really meant what he said, or that once in office he would not become more restrained, more conventional, and more prudent. At first his actions justified this opinion. While he carried out the domestic programs he had advocated, succeeding soon in abolishing all but the forms of democracy and constituting himself fuhrer (leader) of the German people, externally he followed courses somewhat at odds with what he had said and written. In token of peaceful intentions he even negotiated with Poland an agreement relating to the large German minority in that country. In a joint declaration issued on Jan. 26, 1934, the German and Polish governments promised for a period of 10 years not to resort to war to solve differences and not to intervene in behalf of members of their nationality groups who were not legally citizens of their states.

Until the summer of 1934 the only actions of Hitler that excited international apprehension were those concerning armaments. As part of the campaign to revive the German economy, he undertook to increase production by heavy industry, particularly those branches that would make the greatest contributions to a war effort. In May 1933, he asked the other League powers to allow Germany to move immediately toward the "equality" which had been promised her for the distant future. The French refused, pointing out that the promise had always been conditioned on the development of effective international controls. Hitler replied by declaring on October 14 that Germany would proceed to arm herself with or without consent. He announced on the same day his nation's withdrawal (effective in two years' time) from the League of Nations. But the effect of these actions was softened by an offer to France of a bilateral pact in which Germany would agree to limit its army to 300,000 men and its air force to 50 percent of that of France and to accept some measure of international control. Although the French refused this offer, taking the position that they should not sanction German rearmament even in principle, the fact that the offer had been made left it unclear whether or not Hitler was bent on carrying out the external programs outlined in *Mein Kampf*.

The first strong indication that this might be the case came in July 1934 in Austria. That country had a National Socialist Party modeled on Hitler's and more or less openly supported by German officials. In the spring of 1934, the party increased its agitation. Then, when Chancellor Engelbert Dollfuss was assassinated on July 25, it attempted a coup d'état. German official statements and troop movements made it seem that the coup would have active support from across the frontier. The Austrian Nazis had, however, overestimated their strength. Dollfuss' successor, Dr. Kurt von Schuschnigg, quickly consolidated his power. Italian dictator Benito Mussolini meanwhile declared that Italy would not tolerate a change in the status of Austria and moved Italian troops to the Brenner Pass. Whatever plans the Germans had were frustrated by these actions.

See also NATIONAL SOCIALIST (NAZI) PARTY.

**Stresa Front.**—The French became increasingly apprehensive as evidence accumulated to indicate that Hitler planned much more formidable forces than those of which he had spoken in October and November 1933. On March 10, 1935, one of his officials disclosed that the projected German Air Force would be larger than the French. Six days later, Hitler himself proclaimed the reinstitution of compulsory military service.

To cope with the prospective peril, the French had begun to mature a strategy. Foreign Minister Louis Barthou summarized it as an effort "to group the European interests that could be menaced by the rapid revival of Germany." Although Barthou was assassinated at Marseille on Oct. 9, 1934, in company with King Alexander I of Yugoslavia, his policy was carried on (albeit somewhat irresolutely) by his successor, Pierre Laval. To begin with, in January 1935, Laval held formal conversations with Mussolini, seeking a common Franco-Italian front. These conversations were welcomed by the Italian dictator. Soon after the emergence of Hitler he had proposed that Italy, France, Great Britain, and Germany agree to procedures by which they alone, bypassing the League of Nations, might revise the Treaty of Versailles. The French and British had declined, and the resultant Four-Power Pact initialed at Rome on June 7, 1933 (signed on July 15), provided for nothing more than consultation on matters of mutual interest. Now the growth of French apprehension about Hitler gave Italy more leverage.

Mussolini's principal aim was to circumvent the provisions of the League Covenant that might give protection to Ethiopia, for he had been trying unsuccessfully since the early 1920's to make that nation an economic colony of Italy, and at some point before 1933 he had decided to attempt its forcible conquest. He feared that, since Ethiopia had been admitted to the League in 1923, it might be able to win that body's support, but he recognized that if the British and French did not join in collective resolutions and sanctions, these would be ineffectual. A clash between Italian and Ethiopian troops at the watering hole of Wal Wal on Dec. 5, 1934, had just given him a potential *casus belli*. To Ethiopia's appeal for League arbitration he had rejoined that he would settle the incident exclusively in Italy's interest. Now the trip of Laval to Rome, seeking Italian support against Hitler, gave him the opportunity to bargain for the acquiescence of France and perhaps, through France, of Britain.

The formal convention signed by Laval and Mussolini on Jan. 7, 1935, said nothing about Ethiopia: it merely resolved certain issues with regard to French and Italian colonies already existing in Africa. Mussolini declared later, however, that Laval had given him verbal assurance of a free hand in Ethiopia, and Laval himself admitted that he had promised not to interfere with Italian economic penetration there. The Frenchman professed not to have made any commitment with regard to political or military penetration, but what was said and left unsaid gave Mussolini warrant for interpreting the conversations as he did, and he accelerated preparations for war, apparently much less concerned now about interference by the League.

Laval had gotten what he had sought. Another convention, signed on the same day, affirmed that France and Italy would jointly keep watch on



events in Austria and confer about common action if that nation were imperiled, and it was agreed that Mussolini should invite the British to a meeting at Stresa, with the object of adding them to the anti-German front. This conference, held on April 11-14, 1935, was a partial success. All three governments joined in a commitment to oppose, "by all practicable means, any unilateral repudiation of treaties which may endanger the peace of Europe." While this commitment was qualified by a provision requiring the use of League machinery, it seemed a direct warning to Hitler. The Stresa declaration was followed, moreover, by action to open a League debate on the question of whether or not Germany's reinstitution of compulsory military service constituted a unilateral breach of the Treaty of Versailles. On April 17, the Council, with only one abstention (that of Denmark) voted in principle its condemnation of all unilateral violations of treaties and referred the German case to the Assembly.

Meanwhile, Laval began negotiations with the ambassador of the USSR in Paris. On May 2, they announced the signature of a five-year pact pledging mutual assistance in the event that either nation was the victim of aggression. This was followed on May 16 by a similar pact between the Soviet Union and Czechoslovakia. Coupled with the earlier treaties that allied Poland and the Little Entente with France, these accords seemed to close the ring around Nazi Germany, and they were accompanied by movements within all the major European governments to increase spending on armaments. In June 1935, the French ambassador in Berlin, André François-Poncet, reported the German leaders to be more "defeated and discouraged" than he had ever seen them.

**Anglo-German Naval Agreement.**—The so-called Stresa front was short lived. Some members of the British government reacted to the evidence of German rearmament by drawing the moral that the nation should detach itself and avoid such enforced involvement in war as that of 1914. Finding the German government full of protestations of goodwill for Britain, members of this group reasoned that the course of prudence was to eliminate all potential Anglo-German issues. One that had embittered relations between the two countries in pre-World War I years had been naval rivalry, and when the Admiralty reported exchanges with the Germans that revealed the possibility of a bilateral compact on the relative size of the two fleets, considerable official sentiment developed in favor of following it up. This was done, though in the most closely guarded secrecy, and on June 18, 1935, a naval pact with Germany was signed. It provided that Germany could build a fleet of capital ships equal in tonnage to one third, and a fleet of submarines equal to 60 percent, of that of the Royal Navy. In view of the fact that the Treaty of Versailles had set other limits on German naval strength and had forbidden the construction of submarines, these terms constituted acceptance by Britain of Germany's repudiation of those articles. Coming barely two months after the Stresa accords, this pact gave evidence that the nations apparently joined against Germany were in fact far from united.

Nor did the Franco-Soviet accord prove more durable. Laval had always doubted the wisdom of the Barthou policy and inclined toward the

view that France might be better off in league with Germany than against her. On Jan. 13, 1935, the plebiscite promised by the Treaty of Versailles had taken place in the Saar, with more than 90 percent of the voters opting for reunion with Germany, and Laval not only accepted the verdict with good cheer but made the point to diplomats that France would not necessarily be intransigent in all matters that affected Germany. Instead of seeking prompt ratification of the Franco-Soviet Pact by the French Parliament, he held it over (it was carried through that body by his successor, Albert Sarraut, in February 1936), meanwhile evading all suggestions from the Soviet capital of a military convention to supplement it and to make clear how it might be carried out. The Soviets were pressing Laval onto delicate ground, it is true, for a military convention would involve such issues as whether or not Soviet troops could move across Poland or Rumania, and Laval, who had become premier on June 7, 1935, was looking forward uneasily to a national election and to the possibility that the opposition Popular Front, of which the Communists were part, might profit from a closer Franco-Soviet tie. Nevertheless, his hesitations provided further evidence that the unity of Europe against Germany might be an illusion.

**Italo-Ethiopian War.**—Although the British at Stresa had given Mussolini no assurances that they would acquiesce in his conquest of Ethiopia, their reticences had been so interpreted by him and he was strengthened in this view when, in June 1935, Anthony Eden, minister for League of Nations affairs, came to Rome to suggest that Britain might cede to Ethiopia part of British Somaliland so that Ethiopia might in turn appease Italy by ceding to it some land adjacent to Italian Somaliland. Eden even suggested that a way might be found to make Ethiopia a virtual economic protectorate of Italy. Mussolini soon learned that these gestures did not necessarily mean what he thought. When he rejected Eden's proposals and continued preparations for war, the British government moved warships into the Mediterranean Sea as if in preparation for a League vote of sanctions against Italy. On September 11, after Foreign Secretary Sir Samuel Hoare addressed the League Assembly and declared firmly that Britain would be "second to none" in fulfilling her obligations under the Covenant, Mussolini was faced with the very contingency that he thought his diplomacy had prevented: the possibility of League intervention in behalf of Ethiopia. He nevertheless moved forward. When Emperor Haile Selassie ordered Ethiopian mobilization on September 29, he responded by proclaiming national mobilization in Italy. On October 3, his armies attacked from Eritrea and thus opened war.

In Geneva the League Council immediately heard the protests of Haile Selassie's representative. On October 7, with Italy alone abstaining, it voted to condemn Mussolini's aggression as a resort to war in defiance of Article 12 of the Covenant. Referred to the Assembly, this resolution on October 11 won the support of 50 of the 54 members, only Italy and her client states, Albania, Austria, and Hungary, opposing it. It remained for a Coordination Committee of the League to determine what sanctions should be imposed. Here practical rather than moral issues arose, for, as a totalitarian state that had endeavored for more than a decade to achieve national self-

efficiency, Fascist Italy could withstand almost all forms of moral and economic pressure. The only sanctions that would do it serious injury would be closure of the Suez Canal, which would block the sending of reinforcements and supplies, and stoppage of the one vital commodity that Italy had to import in quantity, oil.

Fearing that closure of the canal would lead to war with Italy, the British government, which controlled the waterway, had little inclination to take that step. As for oil, it was doubtful whether a League decree could be effective in view of the fact that the leading producer, the United States, was not bound by the Covenant. Although Congress had enacted a so-called Neutrality Act signed on Aug. 31, 1935), which required embargoes to be laid on exports of munitions to nations at war, it did not apply to petroleum products. While President Franklin D. Roosevelt declared on November 15 that oil and other commodities were "essential war materials" and ought to be included, there was no assurance that American exporters would adopt such a "moral embargo," or that if they did not, Congress would amend the law to cover these items. The American government encouraged the League powers to expect cooperation but could not guarantee it.

When the Coordination Committee brought in its report on October 19, it made only five relatively mild recommendations for sanctions against Italy: embargoes on shipments of arms to her; bans on loans and credits; bans on imports from her; embargoes on exports to her of transport animals, rubber, and a variety of metals; and joint aid to nations that suffered economically as a result of taking these steps. Voted on separately in the Assembly, they were approved by majorities respectively of 50, 49, 48, 48, and 39. Since their practical effect would be slight, the chief hope was that the display of unity in world opinion would impress Mussolini and cause him to change his course. It did not.

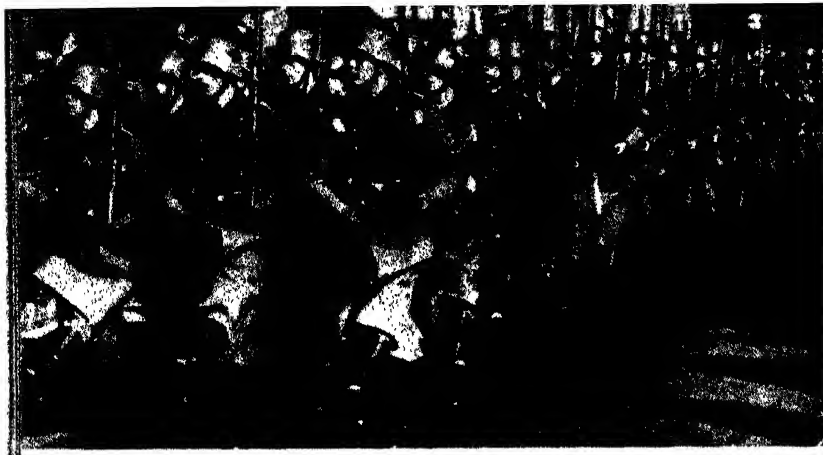
**Hoare-Laval Plan.**—As Italian military operations continued, sentiment grew, especially in Britain, for more effective action. Between January and June 1935, a so-called Peace Ballot, a national referendum supported by the British League of Nations Union and allied groups, had yielded 6,784,368 votes endorsing the principle that, if one nation insisted on attacking another, the other nations should combine to employ not only economic but also military sanctions (10,027,608 favored economic sanctions alone). Although this total encompassed a substantial percentage of the electorate, the result had been discounted by most politicians on the ground that the ballot had probably not been understood fully by its signers. Now, however, they began to consider that it had been more significant. Campaigning in a general election, spokesmen for the government felt obliged to use increasingly vigorous words in speaking of what Britain and the League would do. Returned on November 14 with an overwhelming majority of seats in the House of Commons (431 to 184), the Conservative cabinet was under pressure to live up to its promises.

Those ministers who were dubious about the whole policy of sanctions found this pressure especially onerous. They urged a further effort to induce Mussolini to abandon the war and thus, they hoped, to rescue Britain from the predicament in which she was likely soon to find herself. Precisely what was said and agreed on within the cabinet remains unknown. The result was, how-

ever, that Hoare set off in early December for a skating holiday in Switzerland, and that he paused for two days (December 7-8) in Paris for intensive conversations with Laval. The result of these conversations was an agreement on proposals to be made secretly to Mussolini. He was to be asked to halt the war with the understanding that Italy would receive from Ethiopia the northeastern section of the Tigre, part of the desert of Danakil, all of the Ogaden region, and "exclusive economic rights" in the country south of 8° north latitude and east of 35° east longitude. All that Italy would yield in return would be a corridor giving Ethiopia a camel track to the sea across almost impassable desert. This plan offered Italy almost everything that she could hope to obtain by continuing her campaign.

Convinced that the application of further sanctions would lead to a general war harmful to French interests, Laval had devised these terms. He had also developed the strategy to be followed. The plan was to be put before Mussolini first. After he accepted, it was to be shown to Haile Selassie. When the Ethiopian ruler rejected it, the French and British would be able to say that he had refused peace, and could not only oppose the imposition of further sanctions but also call for the lifting of those that had already been voted. Whatever the outcome for Ethiopia, the crisis between the League powers and Italy would have been bridged, and some facsimile of the Stresa front might be put together again. Even before they could be put into diplomatic cables, however, the terms of the plan leaked to the press. From partisans of Ethiopia and the League there arose an instant and loud outcry. The British and French governments were accused of preparing to betray the interests of a small nation, to sacrifice the principle of collective security, and reward an aggressor. So strong was feeling in Britain that Prime Minister Stanley Baldwin felt compelled on December 18 to request Hoare's resignation and soon afterward to appoint as his successor Eden, the champion of the League. In France, Laval's government barely survived a vote of confidence in the Chamber of Deputies on December 29. From the United States, where sentiment for effective embargoes had been rapidly growing, came a torrent of criticism of British and French shortsightedness.

Mussolini had meanwhile given indication that he would not in any case accept less than the total conquest of Ethiopia. In January 1936, there was discussion within the League of adding an oil embargo to the sanctions. Despite the events that had followed the release of the Hoare-Laval terms, however, official French and British opinion was still opposed to such action. The decision was for delay, pending the outcome of Roosevelt's efforts to amend the American neutrality laws. Since nothing encouraging was done by Congress, nothing at all was done by the League. As it turned out, the limit of its capacities had been reached in the vote of sanctions of October. As winter turned into spring, the Italian offensive in Ethiopia gained momentum. On May 5, 1936, Fascist troops marched into the capital, Addis Ababa. Four days later, Mussolini proclaimed the war ended and Ethiopia part of Italian East Africa. By summer most of the League powers had concluded that they could only accept as a fact the extinction of Ethiopian sovereignty, and the Assembly agreed that sanctions against Italy should be suspended as of July 15. The League's



On March 7, 1936, troops goose-step into Cologne as the demilitarized zone of the Rhineland is reoccupied by German forces in violation of the Treaty of Versailles.

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machinery for maintaining collective security had proved ineffectual.

**Rhineland Coup.**—An even more significant demonstration of this fact came before the Italo-Ethiopian War was liquidated. Seeing the split within the Stresa front, Hitler decided to act in the Rhineland—to repudiate the articles of the Treaty of Versailles that declared that region permanently demilitarized. When he communicated this decision to his generals, they were appalled. In their view the German Army was still comparatively weak, and the air force had relatively little offensive capability. They warned the führer that the French had the power single-handedly to drive a German force from the region and impose humiliating terms. Hitler's response was a simple assertion that the French would not move. He ordered the requisite preparations made.

The legal pretext he found in the Franco-Soviet Pact of 1935. By committing France to act against Germany in the event of German aggression against the USSR, Hitler could argue, this pact constituted a repudiation of the Locarno treaties, in which France had promised never to make war on Germany except in obedience to resolutions by the League of Nations. It also constituted a threat to Germany, he could say, and therefore, despite the Treaty of Versailles, gave warrant for action in self-defense. On March 7, 1936, shortly after the French Assembly's ratification of the Franco-Soviet Pact, he exposed this reasoning in diplomatic notes and in a speech to the Reichstag. He announced that German troops were moving into the demilitarized zone. At the same time, he offered as measures of reassurance to sign nonaggression pacts with France and all Germany's neighbors, east as well as west; to concert with the French a new demilitarization agreement, applying to both sides of the frontier; and to reenter the League of Nations.

The French government was shocked. Premier Sarraut responded with a forceful radio address, declaring, "We shall not leave Strasbourg under the German cannon." As he later testified, however, he and his colleagues were uncertain as to what they would in fact do. Reports by military men on France's capacity to repel the German force were generally pessimistic. The army, they said, was inadequate. It would be necessary to call up reservists in order to fill its ranks. Overestimating the German bomber force, they warned that Paris and other centers lacked the air defenses to prevent devastating raids. Their judgments thus reinforced the feeling that had been instinctive among the principal members of the cabinet

—that France dare not act alone, and that perhaps she should not act even if she received support from abroad.

One capital with which they were particularly concerned was Warsaw. On the day of Hitler's announcement the Polish government gave them reassurance that in the event of a clash it would stand by the alliance of 1921 and proposed immediate conversations. Two days later, on March 9, however, it declared that it accepted the German thesis and regarded the reoccupation of the Rhineland as a legitimate response to the Franco-Soviet Pact. Their objective may have been merely to emphasize that Polish support of France would constitute action above and beyond the 1921 treaty, but the impression given the French government was that the Poles were playing a double game, and that France could not rely on them. The other nation whose support would be crucial to the French in a clash with Germany was Great Britain, and while the British government was more forthright than the Polish, it gave France even less encouragement to stand fast. Eden declared the German action to be inexcusable but not threatening, especially in view of Hitler's offer of nonaggression pacts. Calling for a meeting of the League Council, he said that no decision should be taken beforehand by any government. The only promise he made was that Britain would support France if she were attacked by Germany in the period before the League acted.

The French government was thus informed by its two most important allies that it could not expect backing if it replied to the Germans with force. Some members of the Sarraut cabinet found this news not unwelcome. Perhaps most did, for they faced a general election in May: they felt that a call-up of reservists would cost them votes; and, in view of the identification of their Popular Front opponents with antifascism, they feared that any crisis with Germany might have the same effect. The French press, also preoccupied with domestic affairs, raised little clamor for action. Consequently, on March 11, Sarraut backed away from his earlier position, announcing that the cabinet had decided to seek a solution within the framework of the League of Nations, working in conjunction with the other signers of the Locarno Pact. The League did in fact discuss a resolution condemning the German action. Nothing came of this discussion, however, and the Rhineland question was lost to sight in the pell-mell rush of other events. Hitler's coup had succeeded. Not only the machinery of the League but also the French system of alliances lay in

ruins. There were no longer any collective guarantees of the peace, and the end of the truce of 1918-1919 was in sight.

#### END OF THE LONG ARMISTICE

**Spanish Civil War.**—Hardly were the Ethiopian and Rhineland crises out of mind when a new storm swept the stage. In Spanish Morocco on July 17, 1936, so-called Nationalists launched a revolution against the Popular Front government of the five-year old Spanish Republic (garrisons in Spain proper rose the next day). Championing ideas much like those of the Fascists and Nazis, they applied immediately to Rome and Berlin for aid. The republicans or Loyalists (as they became known) with equal alacrity applied for help to Paris, where the May elections had given victory to the Popular Front and made Leon Blum, a Socialist, premier in June. From the outset the Spanish Civil War was a European problem.

Italy and Germany both agreed promptly to act. Italian ships and planes were soon aiding Nationalist troops to cross from Morocco to the Iberian Peninsula, and before long Italians and Germans were actually fighting in the Nationalist ranks. On November 28, Mussolini signed with the Nationalist leader, Gen. Francisco Franco, a pact providing that Italian aid should be recompensed by economic cooperation, political co-operation in the western Mediterranean, and "benevolent neutrality" on the part of Spain in a general war. Later, on March 20, 1937, Hitler entered into an agreement with Franco that promised consultations in the event of a European war and guaranteed the export to Germany of quantities of Spanish provisions and raw materials.

At first the French government was disposed to give aid to the republicans, and, indeed, Premier Blum immediately authorized sales of aircraft and munitions. But counsels of caution soon came to the fore. With little of the regular army loyal to it, the Spanish Republic seemed unlikely to survive. Since the Spanish Popular Front was somewhat more radical than the French, its cabinet was viewed askance by some members of the Blum government. Officials of the Ministry of Foreign Affairs warned furthermore that assistance to the republicans would probably lead to increased Italian and German assistance to the Nationalists, and that the eventual outcome might well be a general European war. This last consideration was pressed on the French by their British allies. Many in the majority Conservative Party felt that Britain's position should be "a plague o' both your houses." While most Liberals and Labourites praised the republic and damned the Nationalists, few argued that British interests were involved in the civil war. The Baldwin cabinet therefore had mass support in adopting the position that the aim of the democracies should be to quarantine Spain and prevent the conflict from spreading.

Torn within and under pressure from London, the Blum cabinet decided to take a similar stand. On Aug. 1, 1936, it proclaimed a policy of non-intervention, declaring that the Spaniards should be allowed to fight out their war without aid in men or matériel from any other country and asking all other governments to join in this course. A total of 27 nations, including Italy and Germany, agreed, and an international Nonintervention Committee was established in London to keep watch on the fulfillment of these pledges.

In actuality the committee never proved effective. The Italians and Germans continued more or less openly to assist Franco, and the Soviet government, despite its promise to the contrary, contributed men and supplies to the republicans. Even the French wavered from time to time, leaving the Pyrenees frontier open on two occasions (in November 1937 and April-May 1938) for shipments to the republic. Among the European powers only Britain was faithful to the pledge. The United States, though not a party to it, followed the British by applying its neutrality laws to the civil war. Partly because Soviet and French aid to the republic was considerably less than Italian and German aid to the Nationalists, partly because of military advantages on Franco's side, and partly because of divisions among the Loyalists, the Nationalists eventually triumphed. By the end of March 1939, Franco was master of nearly all of Spain.

The Spanish conflict was not the match that touched off a new world war. It did, however, make tensions more acute. Even among those in Britain, France, and the United States who continued to regard nonintervention as a wise policy there were some who felt that Spain represented one more victory for the totalitarian states, and that this fact brought nearer the moment when their career of success would have to be checked. Among the Italians and Germans it strengthened the illusion that the democracies were weak willed and would not resist.

**Sino-Japanese War.**—As the Spanish Civil War rounded out its first year, a crisis arose in another part of the globe. Ever since they had created the satellite state of Manchukuo, the Japanese had been discussing further steps toward national expansion. Moderate factions had advocated the use of peaceful means, particularly the application of economic pressure to China, coupled with efforts to induce the Chinese government to accept a client status. These measures had, however, been only partially successful. Extremist groups had become increasingly restless, and the government had edged steadily toward a more forceful policy.

On April 18, 1934, the official spokesman for the Foreign Office, Eiji Amau, announced that any effort by a Western power to aid China would be opposed by Japan. In effect, this declaration was a Japanese Monroe Doctrine for eastern Asia. In December, Japan gave notice that she would no longer be bound by the Washington Naval (Five-Power) Treaty of 1922, which had stipulated that Japanese tonnage in capital ships should not exceed three-fifths that of Britain or the United States. After attempting unsuccessfully in 1935 to arrange for the secession of the northern provinces of China and the establishment there of another satellite state, the Japanese government on Aug. 11, 1936, devised a new statement of "fundamental principles of a national policy," declaring Japan's destiny to be the dominating force in all of eastern Asia.

Most of the powers with interests in the Far East failed to respond with any vigor. The United States contented itself with mild diplomatic protests, and while the British spoke of extending help to China, they made no move to do so. Only the Soviet Union acted in such a way as to indicate that it might at some point resist a Japanese advance. On March 12, 1936, it signed a mutual defense pact with its client state, Outer Mongolia (Mongolian People's Republic). More important,

Soviet dictator Joseph Stalin advised the Chinese Communists to make peace with the central government and form a common front. Faced with these gestures by the USSR, the Japanese government seized on a proposal from the Germans and on November 25 signed with Hitler an Anti-Comintern Pact. This agreement stipulated nothing more than that the two governments exchange data about, and collaborate in suppressing, Communist activities. Inevitably, however, other governments suspected that it contained secret articles making the two nations allies. The result in both London and Washington was to quicken apprehension concerning possible Japanese aggressive moves. In April 1937, the British government began belatedly to supply financial and technical assistance to China, and American officials talked openly of doing likewise.

Rising prospects for foreign support of China, coupled with various domestic developments, led the Japanese government to decide that it could no longer achieve its objects by peaceful means. On July 7, 1937, taking advantage of a minor clash at the Marco Polo Bridge near Peiping (Peking), the Japanese Army opened a large-scale invasion of China. The other powers still did not act. Britain and the United States delivered diplomatic protests, and on October 6 the League Assembly voted to condemn Japan's action but not to brand it as aggression and not therefore to invoke sanctions. Speaking at Chicago on the previous day, Roosevelt had said that an "epidemic of world lawlessness" was spreading and suggested that, as with an epidemic disease, it might be met by a "quarantine." It soon became clear, however, that he would not go on to advocate combined action against Japan. Instead a meeting was called in Brussels of the 18 nations that had adhered to the Nine-Power Treaty, signed in Washington in 1922 and promising respect for the sovereignty, independence, and territorial and administrative integrity of China. From this meeting issued, on November 24, nothing more

than an exhortation to Japan to mend her ways. The Soviet Union for its part was caught up in a domestic crisis, the result of which was a purge of the leading generals in the army. In August 1938, its forces did engage in a 10-day skirmish with Japanese troops that had infringed the Soviet border. Aside from sending a trickle of aid to the Chinese, however, no power did anything more.

The Japanese were able in 18 months to overrun the area around Peiping, the central Yangtze Basin, and most of the coast of southern China. By the end of 1938 they controlled the richest portions of the country and exercised sway over nearly half its population. In uneasy cooperation with the Communists the Chinese central government was organizing itself for prolonged resistance, and, in fact, war was to continue for more than eight years. Nevertheless, the Japanese aggression seemed at the time to have been an overwhelming success. And in view of the association of the Japanese with the Germans (and after Nov. 6, 1937, with the Italians) in the Anti-Comintern Pact, their triumph seemed another score on the side of the totalitarian states, another encouragement to them, another warning to the democracies.

**The Axis and the Anschluss.**—Even before the Sino-Japanese War the French and British had begun to take some action. Military authorities in both countries estimated (probably erroneously) that the Germans had a long lead in preparations for war. To bring themselves abreast the French decided in October 1936 to undertake a four-year rearmament program, and the British followed their example. The two governments also gave fresh thought to the possibility of redressing the balance by finding allies. Aware of the isolationism of the United States, suspicious of Soviet communism, and apprehensive that in any case the army purges of 1937 might have weakened the USSR, they turned inevitably to the idea of allying themselves with Italy—of recreating the *Stresa* front. Mussolini, however, had been drawing closer to Hitler. After both independently gave aid to Franco, discussion arose about the possibility of cooperation in wider spheres. Hitler, who had prophesied a German-Italian entente in *Mein Kampf*, made the first overtures. In October 1936, the Italian foreign minister, Conte Galeazzo Ciano, visited Germany and arrived at vague understandings on common action against international communism. On November 1, reacting viscerally to the British decision on rearmament, the duce made a speech. In it he spoke of a "vertical line between Rome and Berlin" that was "not a partition but rather an axis round which all European states animated by the will to collaboration and peace can also collaborate." Seizing on his words, commentators soon coupled Italy and Germany as the Axis powers.

They were not yet formal allies. Indeed, from the French and British standpoint, it seemed that they were far from being so. After the settlement of the Ethiopian affair, Italy's paramount interests appeared once again to lie in the Danubian region. And it was there that Hitler seemed most likely to make his next move. He had continued to give strong backing to the Austrian Nazis. In February 1938, through pressure on Chancellor von Schuschnigg, he forced the appointment of Nazis to key posts in the Austrian government. He and they talked openly of an *Anschluss*: a political union. It remained to be seen whether Mussolini would react again as he had in 1934. The Italian dictator did in fact sound out the British govern-

Japanese tanks enter the burning city of Nanking, the conquest of which was completed on Dec. 13, 1937.

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ment on the possibility of an accord. He did not ask that Britain guarantee support against Germany, but merely that it recognize his conquest of Ethiopia and reach an entente with him on Mediterranean issues. This would be enough, he implied, to enable him to stand up to Hitler on the Austrian question. Whether he was in earnest or not remains doubtful. In any event, Foreign Secretary Eden took the view that an understanding with Italy was impossible without the termination of Italian intervention in Spain. Although the majority of the cabinet disagreed with him and he resigned, there was so much support for his position in the House of Commons that the government felt compelled to go slowly.

Meanwhile, Hitler moved. On Nov. 5, 1937, he had disclosed his thoughts to some of his principal political and military subordinates. The next six to eight years, he said, would bring Germany to the peak of her relative power. Thereafter rearmament by other nations, coupled with the obsolescence of German weapons, would mean that any change would be for the worse. "Germany's problem could only be solved by means of force," he declared, and "it was his unalterable resolve to solve Germany's problem of space at the latest by 1943-1945." The first steps would be the conquest of Austria and Czechoslovakia. After that the schedule would depend on circumstances. Morally sure that Italy would not resist, he had made preparations to act against Austria. His demand for the installation of Nazis in key posts in that government was a first step. When Schuschnigg made a sign of defiance, announcing a projected plebiscite in which the Austrian people would register their desire to remain independent, Hitler sent an angry ultimatum demanding its cancellation. Encouraged by Schuschnigg's compliance, he then demanded that a Nazi be installed as chancellor. When rebuffed, he directed Dr. Arthur Seyss-Inquart, Austrian Nazi minister of the interior, to proclaim himself head of a provisional government and invite German intervention. This was done. German troops crossed the border early on March 12. On the following day, Anschluss was proclaimed, and on March 14 Hitler himself was in Vienna. Having received no encouraging reply from London, Mussolini had acquiesced, telling Hitler's envoy that "Austria would be immaterial to him." Since the British had taken the position even in 1934 that Austria was not a direct concern of theirs, they contented themselves with a strong diplomatic protest. The French, embroiled in a domestic crisis and having only a caretaker cabinet, were incapable of even contemplating action. In the series of successes of the dictatorships the conquest of Austria was the most rapid, the most complete, and the most feebly opposed.

**Czech Crisis.**—It was clear to all the world that Czechoslovakia was now in peril. German garrisons ringed its western frontiers, and the German press and radio thundered about persecution suffered by the German minority there. In the Sudetenland, where most of this minority resided, a constant clamor was maintained by Nazi sympathizers whose leaders plainly took their orders from Berlin. Reacting to evidence of German troop concentrations, the Czechs on May 20, 1938, ordered the mobilization of reserves along the German frontier. Their French ally stood by them, warning the Germans not to attack. The British ambassador in Berlin added reinforcement by reminding the German Foreign Office that

Britain was an ally of France, and the Soviet government declared that it would live up to its alliance with Czechoslovakia. This so-called May crisis proved short lived, for on May 22, Hitler sent to Prague assurances that he was not concentrating troops and that he had no aggressive designs.

Although this episode was frequently cited later as an instance in which firmness by the other powers had forced Hitler to back down, the fact was that the crisis was illusory. While the führer intended eventually to move against Czechoslovakia, it had not been in his mind to act so soon after the Anschluss. On April 21, he had ordered the High Command of the Armed Forces (OKW) to bring up to date plans for a Czech campaign, but the work was not completed until mid-May. Hitler was, in fact, giving his approval to this document on the very day when the Czechs mobilized, and the first words of his covering letter were, "It is not my intention to smash Czechoslovakia in the immediate future without provocation, unless an unavoidable development . . . within Czechoslovakia forces the issue." If the May crisis had any result, it may have been to anger Hitler and incline him to advance his timetable. His associates testified later that he was furious at having to give assurances to the Czechs, and on May 30 he revised his directive to read, "It is my unalterable decision to smash Czechoslovakia by military action in the near future." Perhaps, too, the false sense of having been at the very brink of war had a palsy effect on the governments that had momentarily seemed so firm.

In succeeding weeks and months the British showed an increasing disposition to arrange some appeasement of the Germans. Neville Chamberlain was now prime minister, having succeeded Baldwin on May 28, 1937, and he was strongly of the view that the Germans had many legitimate grievances, that it would not be in the interest of the world for the powers to insist obstinately on maintaining the status quo, and that every conceivable step should be taken to avert war. His position in the May crisis had actually been a good deal less firm than it seemed, and he took pains afterward to make this plain. Through newspaper leaks he let it be known that Britain saw merit in the German position on the Sudetenland. On Aug. 3, 1938, he dispatched the 1st Viscount Runciman to Czechoslovakia to devise a formula that might satisfy Hitler. On September 7, in a widely noticed editorial that was probably inspired by the government, the *London Times* went so far as to suggest that the Sudetenland might be allowed to secede and unite itself with Germany. Hitler had meanwhile fixed October 1 as the date on which German forces were to move on Czechoslovakia. By early September, increased agitation by the Sudeten Nazis and the German press and radio gave notice that some kind of climax was approaching. At a party rally in Nürnberg on September 12, Hitler delivered a tirade against the Czechs. Observers reported infantry and armored units moving to the frontiers, and this time there was no question of the fact.

**Berchtesgaden and Bad Godesberg.**—To avert the impending crisis, Chamberlain resolved to meet face to face with Hitler. Although he was 69 years old and had never been in an airplane before, he telegraphed the German dictator offering to fly over at once, and on September 15, Hitler met him at Berchtesgaden. There the prime



Imperial War Museum, London

Adolf Hitler (right) greets Neville Chamberlain (center), arriving at Berchtesgaden on Sept. 15, 1938.

minister asked if Germany would be satisfied by the cession to her of the Sudetenland. When assured that this was the case, he promised to press such a solution on the French and the Czechs. He returned to London sure that a basis for peace had been found and convinced, too, as he noted in a private memorandum, "that here was a man who could be relied upon when he had given his word." On September 18, the premier and foreign minister of France, Édouard Daladier and Georges Bonnet, came to the British capital. Although in the past they had said repeatedly that France would stand by Czechoslovakia, the question of whether or not to repeat this assurance had been debated in their cabinet throughout the day of September 13 without a decision being reached. Their military advisers had warned that the French armies alone could not carry out offensive operations, and that France would still be defenseless in the face of German air attacks. The Czech Army, though 800,000 strong, was not credited with ability to maintain prolonged resistance. Only Soviet troops were in a position to come directly to the aid of Czechoslovakia, and although the USSR had indicated that it would dispatch such troops, they could arrive only by way of Rumania or Poland. Both of these countries had indicated firmly that they would not grant rights of passage, and the Poles had said on September 12 that they would not honor their alliance with France if France were swept into war on account of Czechoslovakia. Daladier and Bonnet were eager therefore to explore any road that might lead to peace. They gave approval to the formula that Chamberlain had brought back from Berchtesgaden, and on September 19 the British and French governments joined in urging the Czechs to accept it.

The initial response from Prague was negative. The government of President Eduard Beneš was well aware that in sacrificing the Sudetenland Czechoslovakia would lose not only valuable resources and industrial plants but also her only natural defenses against Germany, and Beneš had thus far employed every device to prevent its loss. But this initial response was not the final one. Fearful as they were of the Germans, Czech leaders were even more frightened of the Russians. Further dispatches from London and Paris impressed on them the fact that even if the Western democracies went to war in their behalf, British and French troops would not come to Czecho-

slovakia. Soviet troops, on the other hand, might do so. There were persistent hints from Moscow that they would force their way through Rumania or Poland. The general feeling among Czech leaders was that, if so, they would never withdraw. The cabinet, or at least some part of it, decided that the course of wisdom was to accept the sacrifices urged by the British and French. Declaring that he was acting with the knowledge of Beneš, Premier Milan Hodža communicated secretly with Bonnet, requesting a statement that France would not defend Czechoslovakia if the Anglo-French proposals were rejected. With this in hand, he indicated, it would be possible for the cabinet to justify acceptance of them. Bonnet complied, and on September 21 the Czechs gave notice that they would agree to the terms which Chamberlain and Hitler had devised at Berchtesgaden.

Delighted, Chamberlain arranged for another meeting with the führer, this time at Bad Godesberg on the Rhine. When he arrived on September 22, however, he found to his dismay that the Berchtesgaden terms no longer satisfied Hitler. The German now demanded not only that the Sudetenland be ceded to Germany but that it be turned over to her immediately: before 2 P.M. on September 28. Since Chamberlain had envisaged a survey of the area by an international commission and German-Czech negotiations to determine new boundaries, this meant the ruin of all he had arranged. On September 23, he left for home, heavyhearted and doubtful that war could be averted.

**Munich.**—For the next few days, Europe seemed on the verge of war. The Czechs mobilized. Daladier and Bonnet came again to London, where they were assured more or less definitively of British support. They in turn promised backing to the Czechs. On September 26, Hitler spoke at the Sportpalast in Berlin, proclaiming in violent language that the Sudeten issue would be solved in a matter of days, if necessary by force. On the following day, the British cabinet ordered partial mobilization. Air-raid shelters began to go up in London. Chamberlain expressed his attitude in a radio address to the British people. "How horrible, fantastic, incredible it is that we should be digging trenches and trying on gas-masks here because of a quarrel in a faraway country between people of whom we know nothing!" Grasping at straws, he wrote again to Hitler and sent a message to Mussolini requesting Italian influence on behalf of a peaceful settlement. President Roosevelt on September 26 appealed to Hitler to negotiate with the other Europeans.

While the German leader had hoped that France would not act and had counted on the British not to do so, he told intimates that he was ready to make war if it proved necessary. His generals were almost unanimous in holding that Germany was not in fact ready to fight against Czechoslovakia, France, Britain, and probably the USSR, but Hitler appeared to have little regard for their opinions. On the morning of September 28, he seemed prepared to carry out his threat, come what might. Before the 2 P.M. deadline, however, he received Chamberlain's new message, a communication from the French ambassador which indicated that France would go to almost any length to avoid war, and a message from Mussolini proposing an Anglo-French-German-Italian conference to compose the issue. Informing the Western governments that he would post-

pone his deadline until October 1 (the date fixed by his original plans), he agreed to accept the duce's suggestions.

The conference met at Munich on September 29-30. A new plan was put forward by Mussolini. Since it had actually been drawn up in Berlin, Hitler said that he found it a satisfactory basis for negotiation. Chamberlain and Daladier accepted it with few amendments. The four leaders affixed their signatures, and Chamberlain returned to London to declare that he brought back "peace with honour," adding, "I believe it is peace in our time." The Munich agreement stipulated that the Germans should occupy the Sudetenland by October 10; that an international commission, representing the four powers and Czechoslovakia, should arrange the transfer and draw new boundaries not only there but also on the Czech-Polish and Czech-Hungarian frontiers; and that afterward all four powers would guarantee these new frontiers. Dominated by the Germans, the commission awarded to Germany all the border area that had been shown as German in the Austro-Hungarian census of 1910. This included approximately 10,000 square miles and 3,500,000 persons. The commission also approved Polish seizure of the Teschen (Cieszyn, Těšín) region, which took place on October 2, and on November 2 awarded

to Hungary a strip of southern Slovakia and Ruthenia. The deed to the Poles covered about 400 square miles and 240,000 persons; that to Hungary, about 5,000 square miles and 1,000,000 persons.

See also MUNICH CONFERENCE.

**End of Appeasement.**—Hitler, of course, was not satisfied with the Munich settlement. On October 21, only three weeks after signing the accord, he advised his generals that one of their next tasks would be "liquidation of the remainder of Czechoslovakia." Another was the seizure of Memel (Klaipėda), a port on the Baltic Sea which had been taken from Germany and placed under League of Nations auspices in 1919 and had been seized by Lithuania in 1923. While plans for these undertakings were being prepared, he opened a diplomatic offensive on still another front, notifying the Polish government on October 24 that he wished revisions in the statute for the Free City of Danzig (Gdańsk), road and rail corridors through Polish territory to connect Germany with Danzig, and extraterritorial rights in these corridors for German subjects.

In western European capitals, even while joy over Munich was at its height, there was some suspicion about Hitler's future intentions. Daladier was skeptical from the outset that the settle-

Map 1. EUROPE IN 1939 AND GERMAN PREWAR EXPANSION. The map shows the areas over which Adolf Hitler had gained virtual control in the years following his assumption of power in 1933. His next move was to gain control of Danzig and Polish Corridor "problems." The Poles were recalcitrant and Hitler's next move was to take them. Since France and Great Britain were allies



ment would last. Reports from intelligence sources soon aroused similar doubts in members of the British government. Official and public opinion in both countries veered toward the view that appeasement had been given its final trial—that the Munich accords were the last concessions that could be made, and that further demands by Hitler would call for forthright opposition. In March 1939, this changed mood was put to the test. Hitler had paid no attention to diplomats' warnings of it. The French had signed with him on Dec. 6, 1938, a joint declaration guaranteeing the Franco-German frontier and promising the settlement of future differences by consultation. The British had made overtures for economic accords. Though meant as earnestness of desire to make the Munich settlement work, these gestures were interpreted by Hitler as further evidence of spinelessness, and when he next acted, he did so more brazenly than on any occasion in the past.

Having given encouragement earlier to Slovakian separatists, on March 11, 1939, he sent Austrian Nazis to Slovakia to order the Slovaks to proclaim their independence and ask him to become their protector. In the meantime, the Czech president, Emil Hácha, asked to see the führer. He was invited to Berlin and given an audience in the early morning hours of March 15. An almost incredible scene ensued. Hitler told Hácha that there were only two choices: Czechoslovakia could ask to be occupied peacefully, or it could be invaded and its people made to suffer. The führer's deputies literally chased Hácha around a table, trying to force him to sign a proclamation requesting establishment of a German protectorate. When the aged Czech fainted, he was revived with injections. Finally he signed. Hitler immediately ordered his troops to move, and on March 16 he was in Prague, proclaiming that Czechoslovakia no longer existed. Both the Czech and the Slovakian regions became German protectorates. In accordance with a prior understanding the largest part of the Carpatho-Ukraine was turned over to Hungary.

The reactions in Western capitals were mixed. The fact that Hácha had invited German intervention made it hard for the French and the British to do more than protest the violation of the spirit of Munich. On the other hand, even the firmest believers in appeasement were shocked by Hitler's seizing new territory after having said so vehemently that he had no further ambitions and especially by his taking into the Reich 10,000,000 persons who were not of German nationality. The majority of the French cabinet now agreed immediately that, when he moved again, Hitler would have to be stopped by force. At Birmingham on March 17, Chamberlain declared that if the recent German action proved merely a prelude to other attacks on small states, Britain would join in resisting "to the utmost of its power."

The nation most likely to be Hitler's next target was Poland. On January 9, Hitler had renewed his demands with regard to Danzig, coupling with them a secret communication suggesting that Poland might in return obtain eventual cessions of territory in the Soviet Ukraine. On February 1, the Poles refused. On March 21, however, Hitler notified them in threatening language that the Danzig issue would have to be settled. Two days later, German troops seized Memel. The French and British had already indicated that they were prepared to negotiate an alliance with Poland. The chief stumbling block

was the question of whether or not the USSR should be included. Through the commissar for foreign affairs, Maksim M. Litvinov, the Soviets had expressed a desire to be a party to the alliance. Polish leaders, however, looked on this offer with apprehension fully equal to that which had been shown by the Czechs. While exhibiting eagerness for ties with the British and French, they still said firmly that they would not permit Soviet troops to cross their soil. Although most members of the French and British cabinet wanted to form a common front with Poland and the USSR, they concluded that it would be dangerous to wait for a change in the Polish stand. On March 23, as a warning to Hitler, the two governments had declared that they would defend Belgium, the Netherlands, and Switzerland against any attack. This pledge had been made without any *quid pro quo*, and Daladier and Chamberlain decided that their simplest course was to follow the same procedure with regard to Poland. The British prime minister asked if the Poles would have any objection. They said no, and on March 31, Chamberlain announced in the House of Commons:

In the event of any action which clearly threatened Polish independence and which the Polish government accordingly considered it vital to resist with their national forces, His Majesty's Government would feel themselves bound at once to lend the Polish Government all support in their power. They have given the Polish Government an assurance to this effect. I may add that the French government have authorized me to make it plain that they stand in the same position in the matter. . . .

On April 7, Mussolini, imitating Hitler's tactics, invaded Albania. The British and French governments on April 13 extended their guarantee to Greece and Rumania. Abandoning their earlier policies altogether, they now stood ready to go to war automatically if the dictators committed new acts of aggression.

**Nazi-Soviet Pact.**—The Western powers were still desirous of having the USSR on their side. All hope of attaching Italy to their cause had disappeared. On January 4, Mussolini had told Hitler that he was ready to negotiate a comprehensive alliance. Although this so-called Pact of Steel, pledging each nation to join the other immediately in war, was not completed until May 22, Mussolini meanwhile made no secret of where he stood. Chamberlain and Daladier had received some encouragement from the United States. Roosevelt had opened a campaign to repeal the Neutrality acts of 1935–1937 so that American supplies would be available to Britain and France if war came, but he was to find it impossible for the time being to carry Congress with him. In any event, there was no likelihood whatever of early American intervention in their behalf. If there was to be another power allied with them, it could only be the USSR.

Despite Polish opposition, the French and British had continued to discuss a pact with the Soviets. On April 15, the French suggested that the two Western powers and the USSR sign a treaty containing pledges of mutual assistance in the event of war. Thus, while the Soviets would not have any engagement with Poland, they would be obligated to fight for her if the French and British did so. After a long delay resulting partly from concern about Poland's role, partly from distrust of the Soviets, and partly, in all probability, from latent hope for a war between Nazis and Communists in which the democracies could stand aside, Chamberlain's cabinet agreed to the French plan. The proposal was made to

he Russians, and on May 27 negotiations began in Moscow. Troubled from the outset by the issue of whether or not the three-power agreement should explicitly recognize a Russian right of passage through Poland, the negotiations eventually foundered. They were finally suspended on Aug. 21, 1939.

In the meantime, other negotiations had been in progress between the Soviets and the Germans. After giving various subtle indications that Munich had undermined his hope of cooperation with the Western powers, Stalin on March 10 made a speech summarizing the principles of his foreign policy as:

(1) To continue to pursue a policy of peace and consolidation of economic relations with all countries.

(2) . . . Not to let our country be drawn into conflict by warmongers, whose custom it is to let others pull their chestnuts out of the fire.

On May 3, Litvinov was replaced by Vyacheslav M. Molotov, a man who had had no part in the effort to win alliances with the democracies. Speaking with the German ambassador on May 20, the new foreign commissar remarked that mutually profitable economic agreements might be reached if a suitable "political basis" were established.

Although Hitler understood these hints, he was slow to act on them. Not until late in May did he authorize exploratory conversations about a trade pact and related matters. After these went on for some weeks without result, on June 29 he abruptly ordered that they be broken off. On July 18, he learned of Russian proposals for resumption of the talks. Eight days later, his foreign minister, Joachim von Ribbentrop, spent an evening sounding out some Russian officials who were in Berlin. Encouraged by the results of these and other conversations, Hitler decided on a bold gamble. On August 14, he had Ribbentrop propose to the Russians "a speedy clarification of German-Russian relations . . . in due course clarifying jointly territorial questions in Eastern Europe." Now the supplicated rather than the supplicants, the Soviets raised a number of practical issues. In each instance, Hitler responded satisfactorily. By August 20, terms had been agreed on, and on August 23, Molotov and Ribbentrop signed a nonaggression pact in Moscow. The published text bound both governments to refrain from aggressive action or attack against each other, to lend no support to a third party should either "become the object of belligerent action" by one, and to join in no "grouping of Powers whatsoever which is aimed directly or indirectly at the other Party." A secret protocol stipulated that if "territorial and political transformation" should take place in northeastern Europe, the boundary between German and Soviet spheres should follow the northern border of Lithuania and the line of the Narew (Narev), Vistula (Wisla), and San rivers in Poland.

Thus was a temporary diplomatic revolution effected. The Nazi and Soviet dictatorships became allies. Among the great powers only the British and French remained as potentially active opponents of German expansion. After the signature of the pact with the USSR, Hitler reportedly exclaimed, "Now, I have the world in my pocket!"

**Final Crisis.**—On April 3, Hitler had directed his generals to prepare a plan of campaign against Poland, with September 1 as its probable starting date. On May 23, in a conference with top-ranking officers, he disclosed that his intention

was to use the Danzig question as a pretext and "to attack Poland at the first suitable opportunity." Meeting Mussolini's foreign minister at Obersalzberg on August 12–13, Hitler stated that he intended to move against Poland before the end of the month, and that he was confident that Britain and France would not intervene. He expressed this conviction to others. After learning that the pact with the Soviets would become a reality, however, he convoked his generals at Obersalzberg and, in the course of a long, rambling speech, told them that while he did not foresee war in the west it was a risk that had to be run. In any event, he said, delay worked to Germany's disadvantage. If the British and French did nothing about Poland, he intended to strike against them soon after the Polish campaign was over. Economically and militarily, he said, they would profit from further respite while Germany would not. He ordered that the armies be ready on August 26 to move against Poland and, if necessary, to hold the western frontier against an Anglo-French attack. But on August 25, two days after the Nazi-Soviet Pact, the French warned him once again that they would stand by Poland, and on the same day Chamberlain announced the signature of a formal Anglo-Polish alliance. Hitler wavered. Saying that he needed time for negotiation, he ordered the postponement of the operation.

His chosen pretext had been alleged grievances of the German population in Danzig. Clamor there for annexation by Germany and for establishment of road and rail corridors had been augmented since July as a result of the dispatch to the city of several hundred Nazi agents *provocateurs*. Citing the evidence of this agitation, Hitler addressed to Chamberlain a long appeal for understanding and sympathy. Obviously hoping against hope that a peaceful solution would emerge, the British prime minister pressed the Poles to make every concession. They agreed reluctantly to negotiate about the issues Hitler raised. When their ambassador in Berlin gave notice to this effect, however, Hitler refused to deal with him unless he had full powers to reach a settlement on the spot. Exploiting this pretext, he declared to the British and French governments that it was not he but the Poles who were rejecting diplomacy. When the government in Warsaw ordered mobilization on August 30, the German press and radio cried that it was planning an attack. On the following day, there occurred a small incident on the German side of the Polish frontier. According to Hitler's subsequent speech, Polish soldiers attacked a German radio station at Gleiwitz (now Gliwice). Actually the attackers were Germans outfitted in Polish uniforms, commanded by an SS officer, and acting on orders from Berlin.

Hitler had already given the final directive for the invasion to begin at dawn on September 1. It was well under way before he delivered a radio address throwing all blame on the Poles and saying that he had had to meet force with force. When the French and British demanded that he recall his troops, he refused. On September 3, Chamberlain and Daladier gave formal notice to Germany that a state of war existed. The long armistice of 1918–1939 was over.

See also separate biographies of the leading political figures; historical sections of articles on the various powers; *DISARMAMENT—The League of Nations*; *FAR EASTERN AFFAIRS—From World War I to World War II*; *INTERNATIONAL LAW*; *LEAGUE OF NATIONS*; *NATIONALISM AND INTER-*



NATIONALISM; NAVAL CONFERENCES; TWENTIETH CENTURY.

ERNEST R. MAY,  
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### 3. Early Campaigns

#### POLAND

**Approach to Conflict.**—On March 25, 1939, 10 days after he had completely dismembered Czechoslovakia, Adolf Hitler told the chief of the High Command of the Armed Forces (*Oberkommando der Wehrmacht* or OKW), Col. Gen. (later Field Marshal) Wilhelm Keitel, and the commander in chief of the army, Col. Gen. (later Field Marshal) Walther von Brauchitsch, that the time had come to consider solving the Polish problem by military means. A week later, on April 3, Part 2 of the annual directive for the German armed forces, drafted by Hitler himself, set forth a strategic outline for an attack on Poland to be prepared by Sept. 1, 1939. On April 28, in his first open move, Hitler abrogated the Polish-German nonaggression treaty of 1934 and declared that the issue of Danzig (Gdańsk) must be settled. Hitler's turning against Poland surprised no one. On March 31, the British government, attempting to forestall the German dictator, had given a unilateral guarantee of Poland's territorial integrity. (France had a military alliance with Poland dating back to 1921.)

Without hesitating, Hitler pressed forward. At a staff conference held on May 23, he stated that a repetition of the Czech affair was not to be expected. Further successes and the expansion of German *Lebensraum* (space for living) could not be achieved without bloodshed. There would be war. Observers had noted after the Munich Conference (q.v.) of 1938 that the negotiated settlement had angered Hitler. He had wanted a chance to test the new Wehrmacht in action, and he was now determined to have it against Poland. This was the new element in the crisis which Hitler carefully nurtured through the spring and summer of 1939. He did not wish another Munich, but he did wish to cajole, frighten, or simply confuse the British and French sufficiently to keep them from intervening in the neat, small war that he intended to have with his neighbor on the east.

Poland, not a great power, with a population of 35,000,000 was also not a minor nation. In maintaining its national existence against foreign threats, it labored under several handicaps: approximately 10,000,000 of its people were non-Polish, its industrial base was weak, and it included in its boundaries on the north (Polish Corridor, q.v.) and on the east territory to which Germany and the Soviet Union could lay strong claims on ethnic and historical grounds. Polish policy as conducted by President Ignacy Mościcki and Foreign Minister Józef Beck was to stand firm against all of Hitler's demands. The Polish government drew encouragement from the French alliance, the British guarantee, and, apparently, from an underestimate of German strength and an overestimate of its own capabilities.

In the game Hitler started, the Soviet Union could, if it wished, play the last trump. Fear of a two-front war haunted the German military, and even Hitler would not at this time have risked fighting both the Western powers and the Soviet Union. In mid-April 1939, the USSR began negotiations with both sides. The British and French courted the Russians, but Joseph Stalin was not

eager for trouble with Germany. The Russians made the overtures to Germany, first suggesting that the ideological conflict between nazism and communism need not be a bar to a general agreement, and then hinting that the Soviet Union would consider another partition of Poland. Hitler was cool toward these proposals until he realized that the Russians were not merely trying to make use of Germany to raise the price they could extract from the British and the French. His bargaining position was strong: the Soviet Union might have to fight for the Western powers, but all it needed to do for Hitler was to remain neutral and gather in the spoils. How well the Russians appraised the situation was demonstrated on May 3, when Maksim M. Litvinov, a Jew and a long-time advocate of international measures to restrain aggression, was suddenly dismissed as commissar of foreign affairs and replaced by Vyacheslav M. Molotov.

In July 1939, under the guise of conducting summer maneuvers, strong German forces moved into assembly areas on the Polish border. Others were sent to East Prussia on the pretext that they were to take part in celebrating the twenty-fifth anniversary of the Battle of Tannenberg (now Stebark). In the first three weeks of August, German-inspired civil disorders broke out in Danzig and the Polish Corridor, and the remaining units scheduled to participate in the attack moved up to the border. On August 22, Hitler assembled the generals who would command the larger units and told them that the time was ripe to resolve the differences with Poland by war and to test the new German military machine. He predicted that Great Britain and France would not intervene. He intended to begin the attack on August 26.

In Moscow on the night of August 23, Foreign Minister Joachim von Ribbentrop agreed to the final wording of the German-Soviet Nonaggression Treaty, later known as the Nazi-Soviet Pact. A secret protocol placed Finland, Estonia, and Latvia in the Soviet sphere of interest and Lithuania in the German. The border of the Soviet and German spheres in Poland was established on the Narew (Narev), Vistula (Visla), and San rivers. Because time was pressing for Germany, the treaty was to go into effect as soon as it had been signed.

In a last attempt to intimidate Hitler, Great Britain announced on August 25 that she had entered into a full-fledged alliance with Poland. On the same day, Hitler's ally Benito Mussolini informed him that Italy would not be able to take part militarily in any forthcoming war. These two reverses were not significant enough to deter Hitler, but they did cause him to hesitate. He canceled the August 26 starting date for the attack. For the next six days all of his moves were directed toward two objectives: the division of Poland and the West by various schemes and proposals for negotiations which he knew the Poles would not accept; and the undermining of French and British confidence by means of the recent agreement with the Soviet Union.

On August 31, Hitler signed Directive No. for the Conduct of the War. During the night, SS units staged "incidents" along the border, of which the most notorious was an alleged raid on the radio station at Gleiwitz (now Gliwice) in Silesia. Before sunrise on the next morning, Sept. 1, 1939, the war began as the German armies marched into Poland. Two days later, when Great Britain and France declared war, Hitler said to

Motorized German soldiers take diverging paths near Bydgoszcz, captured on Sept. 3, 1939, in the Nazi invasion of Poland.

Wide World



Ribbentrop, "... it does not mean they will fight."

See also section 2. *Between World Wars.*

**German War Plan.**—The fundamental concept of the German plan was to fight a short war that would be over before the British or French armies could get into action—over, in fact, before the Western powers could even make up their minds to fight. The plan was given its final form in an operation order issued by the Army High Command (*Oberkommando des Heeres* or OKH) on June 15. The order provided for two groups of armies, Army Group North commanded by Col. Gen. (later Field Marshal) Fedor von Bock and Army Group South under Col. Gen. (later Field Marshal) Gerd von Rundstedt.

Army Group North was to strike eastward from Pomerania (Pomorze) into the Polish Corridor with one of its two armies, the Fourth Army. The other, the Third Army, would strike westward from East Prussia into the corridor and southward toward Warsaw (Warszawa). When the armies had made contact in the corridor, they would both turn their full strength toward the capital. Army Group South, with the Eighth, Tenth, and Fourteenth armies, was to advance to the northeast from Silesia and Slovakia. The Tenth Army, the strongest of the three, would strike directly toward Warsaw, while the Eighth and Fourteenth armies covered its left and right flanks, respectively. The junction of the Tenth Army with elements of Army Group North at Warsaw would complete the encirclement of any forces in western Poland that had not been destroyed before then. This presumably would end the war. Bock proposed extending the arms of the encirclement east of Warsaw to prevent Polish troops' escaping into the Pripyet (Pripyat) Marshes, but nothing was done about this suggestion until after the campaign had begun.

The strength of Army Group North was 630,000 men; that of Army Group South, 886,000. Army Group North was supported by the First Air Force, which controlled 500 bombers, 180 dive bombers (Stukas), and 120 fighters. The Fourth Air Force supported Army Group South with 310 bombers, 160 dive bombers, and 120 fighters. The Air Force High Command (*Oberkommando der Luftwaffe* or OKL) held in reserve 250 Ju-52 transports for paratroop operations. The navy intended to use the World War I battleship *Schleswig-Holstein*, 3 cruisers, and two flotillas of destroyers to bombard shore installations at Gdynia and Hel (Hela).

**Polish Defense Plan.**—The one chance that Poland might have had to counter the German invasion successfully was to fight a delaying action

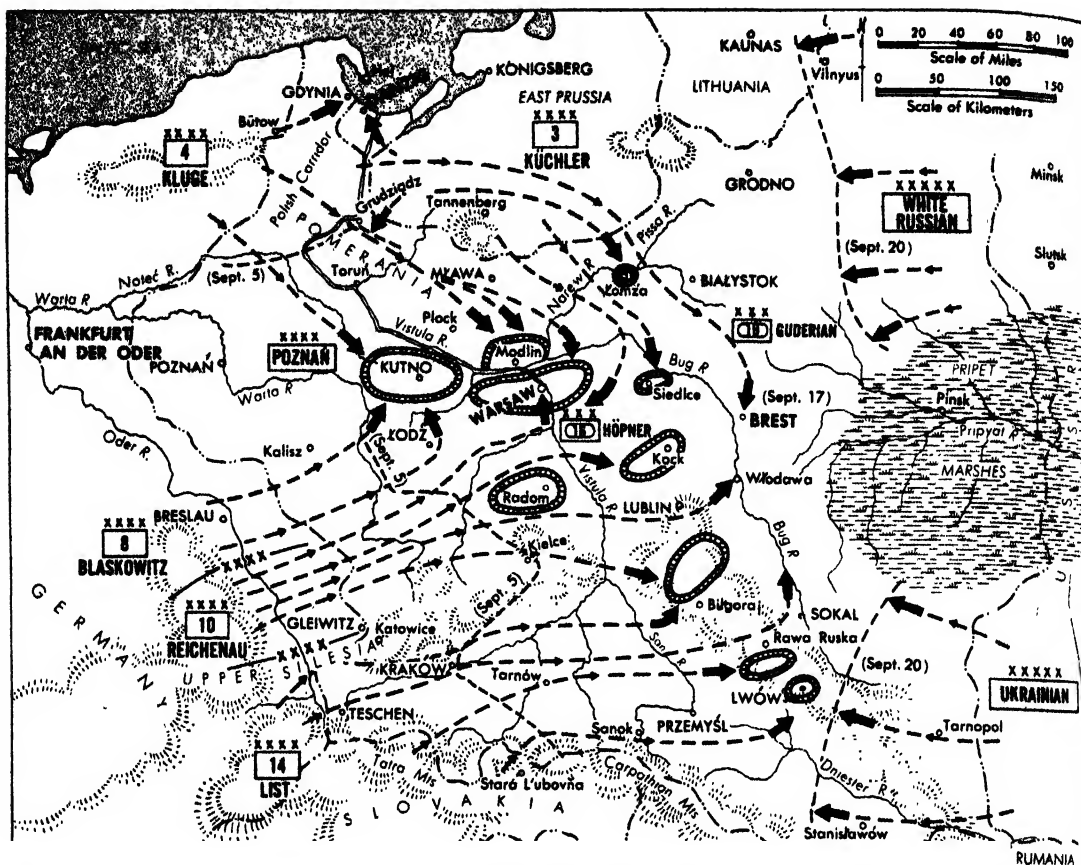
back to the Narew-Vistula-San line and to hold there until the Western powers could bring their forces to bear. This strategy would, however, have sacrificed the country's industrial base and so carried with it the seeds of eventual defeat. The Polish General Staff chose instead to defend all of its frontiers with seven armies and several smaller groupings in territorial deployment. It thereby eliminated at the outset the possibility of concentrating its strength at the most gravely threatened points. The planners apparently believed that the war, following older patterns, would begin with border skirmishes that would only gradually evolve into full-scale battles.

The Polish commander in chief was Marshal Edward Smigly-Rydz, inspector general of the armed forces. The army's full potential strength was about 1,800,000 men. Mobilization began in July, and apparently more than 1,000,000 men were called up, about 800,000 of them west of the German-Soviet demarcation line. Most of the weapons in the army's stocks dated from World War I, and its armor, except for a few light tanks, consisted of some companies of armored scout cars. The air units had 935 aircraft, less than half of which were modern. The navy consisted of 4 destroyers, 5 submarines, and some smaller craft.

**Campaign.**—On the morning of September 1, the Luftwaffe struck at the Polish airfields, destroying nearly all of the planes before they could get off the ground. It then set about systematically disrupting the railroads and lines of communications. Before the day ended, the Polish leadership was helpless. Mobilization could not be completed, and large-scale troop movements were impossible.

The first phase of the campaign, the breakthrough on the borders, ended on September 5. By September 7, the point of the Tenth Army was 36 miles southwest of Warsaw. The Eighth Army on the left had kept pace, executing its mission of protecting the flank, while the Fourteenth Army on the right had captured the Upper Silesian industrial area. By September 5, the two armies in Bock's Army Group North had cut across the corridor and had begun turning to the southeast, and two days later elements of the Third Army reached the Narew 25 miles north of Warsaw. The Poles fought gallantly, but cavalry was no match for tanks. On September 6, the Polish government left Warsaw for Lublin; later it moved close to the Rumanian border, which it crossed on September 16.

The second phase of the campaign completed the destruction of the Polish armed forces. According to the German plan, this was to have been



Map 2. CONQUEST OF POLAND (Sept. 1–Oct. 6, 1939). Adolf Hitler's occupation of Czechoslovakia exposed Poland's vital industrial complexes west of the Vistula and San rivers to German attack from three directions—north, west, and south. The extended Polish defenses along the border were easily pierced by the new German blitzkrieg. Though the Poles fought valiantly, they were forced to capitulate between the German pressure from the west and the Soviet advance from the east. The Ribbentrop-Molotov Line demarcating the German and Soviet areas of influence, mentioned in section 14, *Diplomatic History*, ran along the eastern border of Lithuania, thence along the Pissa, Narew, Vistula, and San rivers; the Curzon Line extended from the southern tip of Lithuania southward to the Bug River near Brest, thence southward along the Bug, turning west at Sokal, and then south-southwestward to the Czechoslovakian border.

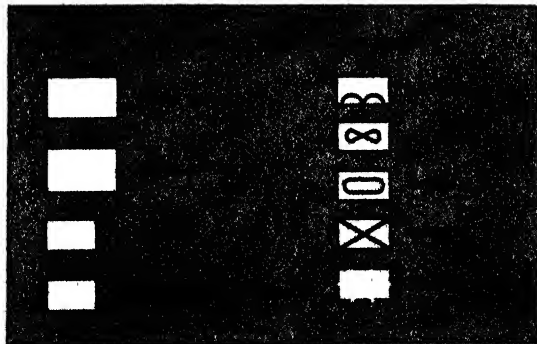
accomplished in a single giant encirclement west of the Vistula. After intelligence reports indicated that the government and large numbers of Polish troops had fled across the river, the plan was changed in accordance with Bock's earlier proposals. The OKH, on September 11, ordered a second deeper envelopment, reaching eastward to the line of the Bug (Western Bug) River.

In the meantime, the closing of the inner ring at Warsaw had created the first and only genuine crisis of the war. The Polish Poznań Army, bypassed in the first week, at the beginning of the

second week felt the German pincers closing behind it. Turning around, it attempted to break through to Warsaw. For several days after September 9, staffs of the German Eighth and Tenth armies were put to a severe test as they swung some of their divisions around to meet the attack coming from the west. The Poles did not break through, however, and the ring gradually closed. On September 19, the Poznań Army, numbering 100,000 men, surrendered, ending the last resistance by a major Polish force.

The most spectacular feature of the outer envelopment was the advance of Gen. (later Col. Gen.) Heinz Guderian's panzer corps from East Prussia across the Narew to Brest (Brest-Litovsk), which it took on September 17. Elements of the corps then continued past the city to make radio contact with the Tenth Army spearhead at Włodowa, 30 miles to the south.

The war ended for all practical purposes on September 19. The fortress at Lwów (now Lvov) surrendered two days later. Warsaw itself held out until September 27. Modlin capitulated on September 28, and the last organized resistance ended on October 6, when 17,000 Polish troops surrendered at Kock. In the whole campaign the Germans took 694,000 prisoners, and an estimated 100,000 men escaped across the borders into



Lithuania, Hungary, and Rumania. The Germans lost 13,981 killed and 30,322 wounded; Polish losses will probably never be known.

**Soviet Intervention.**—Hastening to end the war before the Western powers could act, the Germans on September 3 requested the Soviet Union to move against Poland, but the Russians were not ready. The German speed had taken them by surprise. After the German ambassador in Moscow submitted a second request on September 10, the Soviet government apparently became concerned lest the war end before it could enter it and the Germans refuse to honor the secret protocol and evacuate the territory east of the demarcation line.

On September 17, two Soviet army groups, the White Russian Front in the north and the Ukrainian Front in the south, each with two armies, marched into Poland. They met little Polish resistance and concentrated their efforts on shepherding the Germans out of the Soviet zone. A last-minute German attempt to secure control of the oilfield south of Lwów in the Soviet zone had aroused suspicion. Approximately 217,000 Polish troops fell prisoner to the Russians. Many of them survived to fight Germany again either in the west or in Soviet service, but some thousands, mostly officers, found their graves in Katyn Forest.

**Partition.**—In formulating the secret protocol to the nonaggression treaty, both Germany and the Soviet Union had assumed that a truncated independent Polish state would be allowed to survive. On September 25, however, having made a hint to this effect six days earlier, Stalin proposed that the conquerors divide Poland between them. In Moscow, on September 28, Ribbentrop signed a Soviet-German treaty of friendship. A secret protocol revised the demarcation line. Germany received the Province of Lublin and the Province of Warszawa eastward to the Bug River, and as compensation the USSR included Lithuania in its sphere of influence. The Soviet Union also agreed to deliver to Germany 300,000 tons of crude oil annually, the estimated output of the Polish fields. The revision placed the Soviet border approximately on the Curzon Line (q.v.) and gave Germany nearly all of the ethnically Polish territory. On the same day, Ribbentrop and Molotov issued a statement claiming that the settlement had created a basis for a lasting peace in eastern Europe and calling for an end to the war between Germany and the Western powers.

See also POLAND—9. *History* (World War II: 1939–1945).

#### FINLAND: THE WINTER WAR

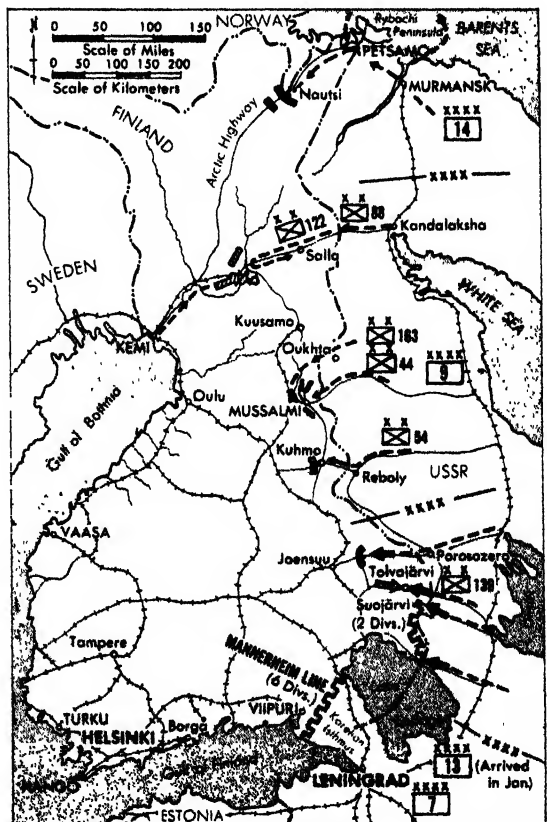
Beginning in the last two weeks of September 1939, the Soviet Union forced the three Baltic states, Estonia, Latvia, and Lithuania (qq.v.), to enter negotiations leading toward mutual assistance treaties granting rights to station Soviet troops and build Soviet bases on their territories. On October 5, the day Latvia signed its treaty, the Soviet government extended its diplomatic offensive to the north with a demand that Finland send plenipotentiaries to Moscow to negotiate political questions raised by the outbreak of the war. When the negotiations began on October 12, the Russians demanded a mutual assistance pact, a 30-year lease on a base at Hangö (Hanko), several islands in the Gulf of Finland, the western half of the Rybachi Peninsula, and a broad strip of Finnish territory on the Karelian Isthmus. The

talks continued into November without producing agreement on the two main questions: Hangö and the Karelian Isthmus.

On November 26, the Russians staged an "incident," an alleged Finnish artillery attack, at Mainila on the Karelian Isthmus. Two days later, they abrogated their nonaggression treaty with Finland, and on November 30 opened the war with heavy air raids on Helsinki and strong attacks by ground forces at several points from the border north of Leningrad to the Arctic Ocean. On December 1, in (as it developed) an extremely premature move, the Soviet government announced that it had created a People's Democratic Republic of Finland under an old-line Bolshevik, Otto W. Kuusinen.

The lengthy preliminaries had given the Finnish Army ample time to complete the mobilization that it had begun on October 14. During the summer volunteers had started building field fortifications on the Karelian Isthmus, but nothing resembling the mythical "Mannerheim Line," which the Russians later invented to excuse their reverses. Finland mobilized 9 divisions and some single companies and battalions, or a total of 175,000 men. Plans had called for 15 divisions,

**Map 3. SOVIET-FINISH WAR (Nov. 30, 1939–March 12, 1940).** The refusal of the Finns to accede to the territorial demands of the USSR brought on a Soviet offensive along the entire border. Though hopelessly outnumbered, the skillful Finns administered to the attackers several embarrassing reverses and frustrated them for several months. After a pause to reorganize and bring up additional forces, the Russians launched an attack by two huge armies up the Karelian Isthmus and against the Finnish Mannerheim Line. Overwhelmed by sheer power, the Finns were forced to capitulate.



but lack of weapons and equipment made this goal unattainable. In the course of the war, Finnish strength rose to about 200,000 men, and foreign volunteers, including a 300-man Finnish-American Legion, added another 11,000. The Lotta Svärd, an auxiliary force of 100,000 women, performed invaluable service in relieving men for frontline duty.

The Soviet High Command deployed four armies under the command of Gen. (later Marshal) Semyon K. Timoshenko on the Finnish frontier: the Seventh Army on the Karelian Isthmus, the Eighth Army north of Lake Ladoga, the Ninth Army in the Rebol (Repola)-Ukhta (Uhtua)-Kandalaksha (Kannanlahti) sector, and the Fourteenth Army on the Arctic coast. The total Soviet troop strength was about 1,000,000 men in 30 divisions. Approximately 1,000 tanks and 800 aircraft lent weight to the offensive.

The Finnish commander in chief, Field Marshal (later Marshal of Finland) Baron Carl G. E. Mannerheim, assembled 6 of his divisions on the Karelian Isthmus, stationed 2 divisions on a short line north of Lake Ladoga, and held 1 division in reserve. Nearly 600 miles of frontier northward to the Arctic coast could be screened only by scattered companies and battalions. Mannerheim had no choice but to mass his forces on the isthmus, the most direct route into the heartland of Finland, the narrow coastal strip between Helsinki and Viipuri (now Vyborg).

Most alarming for the Finnish High Command were the strength and speed with which the Soviet forces moved against the long frontier north of Lake Ladoga. In what at the time seemed a near miracle, two Finnish regiments under Col. (later Gen.) Paavo Talvela beginning on December 12 attacked and destroyed the Soviet 139th Division at Tolvajärvi (now Tolvayarvi), and then defeated the 75th Division. In a nearly month-long battle that began on December 11, a second small force under Col. (later Gen.) Hjalmar F. Siilasvuo encircled the Soviet 163d Division at Suomussalmi and destroyed the 44th Division, which had come to break the encirclement. These victories put an end to Russian attempts to sweep around Lake Ladoga from the north and to cut across the waist of Finland to the Gulf of Bothnia, and they also raised Finnish morale.

During the early fighting the Finns developed their celebrated *motti* (literally, a bundle of sticks) tactics. The *mottis* were small, tight encirclements suited to the heavily forested Finnish terrain. In one of the later battles the personnel of a single Soviet division was trapped in 10 separate *mottis*.

The Finnish divisions on the Karelian Isthmus fought a delaying action in early December, withstood a full-scale assault on their main defense line at mid-month, and on December 23 counterattacked. The counterattack failed to gain much ground, but it took the Soviet command by surprise, and during the entire next month the fighting on the isthmus subsided into positional warfare.

In January 1940, Marshal Kliment Y. Voroshilov assumed over-all command, and Timoshenko took command on the isthmus, where the Thirteenth Army had been moved in on the right of the Seventh Army. The Soviet setbacks had resulted from a combination of supply problems, a winter of record cold, rigid and unimaginative leadership, and a lack of coordination between the various services. Mannerheim described the So-

viet attacks in December as similar to a performance by a badly directed orchestra. In January, the Soviet High Command pulled out units and retrained them immediately behind the front.

On February 1, the Russians opened their final offensive on the Karelian Isthmus. By that time, Soviet propaganda had inflated the Mannerheim Line into something like a super-Maginot Line. The offensive made steady if not rapid progress. On March 4, Soviet units on the west side of the isthmus began attacking across Viipuri (Vyborg) Bay, where the ice had frozen thickly enough to carry tanks. A few miles farther, and the Russians would have reached the open country north of the isthmus. On March 6, the Finnish government sent a deputation to Moscow, and on March 12 the Treaty of Moscow was signed, ending the war. The Finnish Army was still holding well, but, since it had suffered casualties of 24,923 killed and missing and 43,557 wounded, lacked manpower to continue much longer. The Russians probably lost about 200,000 men killed in battle or by the cold.

The terms of the treaty were onerous. Finland was forced to cede the Karelian Isthmus, including Viipuri and a strip of territory northeast of Lake Ladoga, the islands in the Gulf of Finland, the western half of the Rybachi Peninsula, and territory around Salla (now Kuolayarvi) and Kuusamo. The Soviet Union also acquired a 30-year lease on Hangö for use as a naval base. Finland lost its most defensible territory and had to absorb 400,000 refugees into an already badly shaken economy.

See also FINLAND—History (Russo-Finnish War).

#### NORWAY AND DENMARK

**German Planning.**—When the campaign in Poland ended, the Germans, contrary to widely held opinion at the time, did not have a clear idea of what to do next. In a conference held on Sept. 23, 1939, Hitler raised the question of measures to be adopted "in case" the war against Great Britain and France had to be fought to a finish. The possibility of unrestricted submarine warfare, to be proclaimed as a "siege of Britain," was considered.

If Hitler had decided on the siege of Britain, it would have had to be executed by the German Navy and Air Force. On October 3, the commander in chief of the navy, Grand Admiral Erich Raeder, told his staff that he believed the navy could operate more effectively against the British Isles if it were to acquire one or two bases in Norway, possibly at Trondheim and Narvik. His thinking reflected the opinion, common in German naval circles after World War I, that the German Navy would have made a better showing in that conflict if, instead of being bottled up in the North Sea, it had had Norwegian bases to use as ally ports on the Atlantic. When it investigated the question of Norwegian bases on Raeder's orders, the Naval Staff learned that the chief of the Army General Staff, Col. Gen. Franz Halder, was pessimistic. He did not think that the army could either take or defend bases in Norway. The Naval Staff itself concluded that it was to Germany's advantage to keep Norway neutral, especially since the navy lacked sufficient ships to use the proposed bases for full-scale sea warfare. By taking the bases, it decided, Germany might lose more than she gained. While Norway remained neutral, its territorial waters afforded safe routes



German soldiers pass through a burning village during their invasion of Norway in April 1940.

Wide World



for German blockade-runners and for ships bringing Swedish iron ore down from Narvik. The German war industry was completely dependent on Swedish ore, which in winter, when the Baltic Sea froze, could be shipped only via Narvik.

During October and November, Hitler devoted all of his attention to plans for invading France and Belgium. Raeder tried to interest him in the Norwegian bases but failed until December, when he persuaded Hitler to grant an interview to Vidkun Quisling, who led a Norwegian copy of the Nazi Party. Quisling claimed to know that the Norwegian government had secretly agreed not to oppose a British invasion. After talking to Quisling, Hitler, on December 14, ordered the OKW Operations Staff to investigate the possibility of occupying Norway.

That Hitler began to think about Norway was not entirely Quisling's work. Soviet aggression against Finland had aroused strong sympathy for the Finns and had unleashed a wave of anti-German sentiment in Scandinavia. While Germany took a neutral stand that favored the Soviet Union, the Allies had begun talking about sending troops to help the Finns. If troops were sent, the shortest route would be through Narvik and across northern Sweden, directly past the Kiruna-Gällivare ore fields so important to Germany.

In January 1940, the Foreign Political Office of the Nazi Party undertook to maintain contact with Quisling and provide financial support for his party. Ignoring Quisling, OKW continued its planning on a small scale and in secret. Hitler did not show any real enthusiasm for the Norwegian venture until after February 16. On that day the British destroyer *Cossack* entered Norwegian territorial waters and took 300 captured British seamen from the German tanker *Altmark*. The *Altmark* had been the supply ship for the ill-fated commerce raider *Admiral Graf Spee*. Hitler became convinced that the British no longer intended to respect Norway's neutrality. On February 21, he called in Gen. (later Col. Gen.) Nikolaus von Falkenhorst, commanding general of the 21st Corps, and gave him the mission of planning and (if it were to be executed) commanding an operation against Norway.

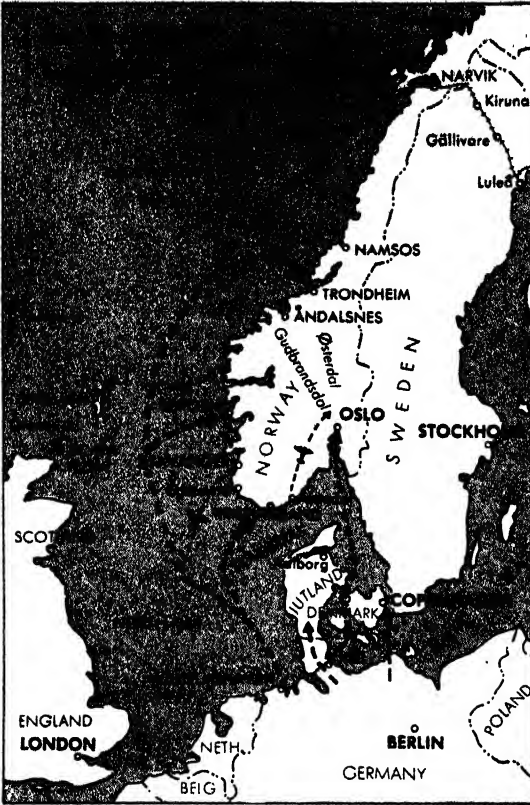
Signs that the British and French intended to use the Russo-Finnish War as an excuse to intervene in Scandinavia added urgency to German planning in late February and early March. On March 7, Hitler assigned 8 infantry divisions and a motorized brigade to Falkenhorst. Toward the middle of the month radio intercepts indicated that troop transports were loading in British ports.

Another intercept, on March 15, revealed that the Soviet-Finnish armistice had spoiled the Allied plans. The armistice also deprived Hitler of his excuse for moving against Norway, and some of the officers in the planning group began to doubt whether it was worthwhile to go ahead. On March 26, however, Raeder told Hitler that, although Allied landings need not be expected in Norway in the near future, Germany would have to face the question sooner or later. He advised that Germany act as soon as possible, because the nights in northern latitudes would be too short to afford good cover for naval forces after April 15. Hitler agreed. On April 2, after reviewing the plans and learning from the air force and navy that the weather would be satisfactory, he named April 9 as the day for the landings.

**Allied Intentions.**—A British-French staff paper of April 1939 on strategic policy recognized that in the first phase of a war with Germany economic warfare would be the only effective Allied offensive weapon. In the light of this fact and of World War I experience in blockading Germany, Norway inevitably assumed a special importance for the Western powers as soon as war broke out. Before mid-September, the British government had made its first attempt to secure from Norway a "sympathetic" interpretation of its rights as a neutral.

The Soviet attack on Finland at the end of November aroused the hope that Norway and Sweden, motivated by sympathy for Finland and by their duty as members of the League of Nations, might permit Allied troops sent to aid the Finns to cross their territory. Such an undertaking could be made to include the occupation of Narvik and of the Swedish ore fields almost automatically. After Field Marshal Mannerheim appealed for aid on Jan. 29, 1940, the Allied Supreme War Council decided to send an expedition timed for mid-March. The plan, while ostensibly intended to bring Allied troops to the Finnish front, placed its emphasis on Norway and Sweden. The main force was to land at Narvik and advance along the ore railroad to its eastern terminus at Luleå, Sweden. Only after two brigades were firmly established along that line would a third brigade be sent into Finland. The preparations moved slowly, and the two governments never quite faced the question what they would do if Norway and Sweden refused transit rights or decided to fight. After Finland accepted the Treaty of Moscow on March 12, the whole project collapsed.

On March 21, Paul Reynaud became the head



**Map 4. CONQUEST OF DENMARK AND NORWAY (April 9–June 9, 1940).** To circumvent a suspected Allied occupation of Norway and to obtain naval and air bases on the open seas, Adolf Hitler decided to occupy Norway. German forces, landed by air and by sea, quickly gained virtual control of the country. Denmark, in the path of the invasion, succumbed without opposition. Anglo-French relief forces, landed in central Norway in mid-April, were soon forced to withdraw by constant German air and ground attacks. Those forces landed at Narvik were evacuated early in June as the Allied front in western Europe collapsed. The German Navy suffered serious losses, but later German submarines and aircraft based in Norway were to exact a frightful toll from Allied convoys attempting to bring much-needed supplies to the Russians at Murmansk.

of a French government committed to a more aggressive policy, and a week later the Supreme War Council again raised the Scandinavian question. A new plan called for two related operations: the laying of minefields in Norwegian waters; and landings at Narvik, Trondheim, Bergen, and Stavanger, to be justified by the expected violent German reaction to the minelaying. After some delays the mines were laid on the morning of April 8, but by then the German Fleet was already advancing up the Norwegian coast.

**German Landings.**—The initial German invasion force for Norway totaled 10,500 men. Provisions were made to introduce an additional 16,700 men through Oslo in the first week and 40,000 more thereafter. The plan called for a peaceful occupation of the country, allegedly to protect Norwegian neutrality. Falkenhorst's staff concluded that landings at Narvik, Trondheim, Bergen, Stavanger, Kristiansand, Egersund, Arendal, and Oslo would place the major centers of population in German hands and effectively crush

Norwegian attempts to mobilize. The earlier planners had considered that it would be sufficient to extract several bases from Denmark by diplomatic pressure, but Falkenhorst decided that it would be safer to take military possession of the country as a land bridge to Norway. To this task he assigned, under Gen. Leonhard Kaupisch, the headquarters of the 31st Corps, 2 infantry divisions, and a motorized brigade.

The first plans had called for an attempt to sneak troops into the Norwegian ports aboard merchant ships. Falkenhorst's staff considered this project too dangerous and decided instead to transport all of the landing teams (except the one for Stavanger, which was to go by air) in warships. Merchant ships were restricted to carrying supplies and troops for landings on the Danish islands, where they would not have to venture outside the German-controlled Baltic Sea. The decision to use warships made the landings the most hazardous phase of the operation: if the vastly superior British Fleet had put in an appearance, it might have destroyed virtually the whole German Navy.

The first two groups of warships sailed on April 7, escorted by the battle cruisers *Scharnhorst* and *Gneisenau*; 10 destroyers were bound for Narvik, and the cruiser *Hipper* and 4 destroyers for Trondheim. Nine other warship groups sailed at intervals that depended on their speeds and on the distances they had to travel. They consisted of the heavy cruiser *Blücher* and the pocket battleship *Lützow* bound for Oslo, several older cruisers, training ships, torpedo boats, and a variety of smaller craft carrying landing parties to Denmark. A British aircraft sighted the first two warship groups six hours after they sailed, but Admiral of the Fleet Sir Charles Forbes, commander in chief of the Home Fleet, concluded that the battleships, cruisers, and destroyers were setting out on a raiding mission into the Atlantic and sent his own ships steaming northward behind them, leaving the North Sea open for the remaining German warship groups.

The landings were executed on time on April 9 everywhere except at Oslo. There the old guns (Krupp model 1905) of the Oscarsborg fort 18 miles south of the city sank the *Blücher* and held the rest of the ships off until the following day. The delay gave the Norwegian king, Haakon VII, and the government time to escape from the capital and made conclusive the failure of the plan to occupy the country without a fight.

In the case of Denmark everything went exactly according to plan. On April 9, one division and the motorized brigade advanced northward across the border into Jutland (Jylland), and the other division staged landings on the islands. Early the same morning, the German minister, Dr. Cecil von Renthe-Fink, presented himself at the Foreign Ministry in Copenhagen (København) with a demand for surrender and assurances that the country would be permitted to retain much of its internal sovereignty. After he added that planes were on their way to bomb the city, the Danish government capitulated at 7:20 A.M.

In executing the Norwegian landings, the German surface fleet achieved its greatest success of the war. It also suffered near-crippling losses. The cruisers *Königsberg* and *Karlsruhe* were sunk before they could leave Norwegian waters, and in two battles (April 10 and 13) British ships sank the 10 destroyers which had taken troops to Narvik.

**Norwegian Campaign.**—On the morning of April 9, Norwegian Foreign Minister Halvdan Koht told Dr. Curt Bräuer, the German minister in Oslo: "We will not submit. The battle is already in progress." But how to fight was another matter. The Norwegian Army's total strength was 15,320 men, and half of them were stationed in the Arctic as an aftermath of the Russo-Finnish War. On April 9, the Germans captured a good share of the army's equipment and all the key communications centers. Two days later, from his headquarters at Rena north of Oslo, the Norwegian Army's commander in chief, Gen. Otto Ruge, had effective control of only one division. With that he planned to delay the German advance north from Oslo and hold open a field of operations in the interior for an anticipated Allied expeditionary force.

The first problem for the Germans was to establish land contact between Oslo and the landing parties in the other coastal cities. By April 16, Falkenhorst had units advancing northward toward Trondheim through the two great valleys, the Gudbrandsdal and the Østerdal. Between April 18 and 23, two British brigades, totaling about 6,000 men, landed at Andalsnes south of Trondheim. Another 6,000 British and French troops went ashore at Namsos to the north of the city. At Tretten on April 23, the Germans defeated one British brigade which had advanced southward into the Gudbrandsdal from Andalsnes, and thereafter the British withdrew to Andalsnes, where their last troops were evacuated on May 2. The German units coming from Oslo had made contact with their Trondheim detachment the day before. In the meantime, the British and French had decided also to evacuate Namsos, which they did on May 3. The last Norwegian resistance in the area south of Trondheim ended on the same day, when the 2d Division surrendered on the Dovrefjell.

At Narvik events at first took a different course. The city could not be reached by land except through Sweden, and it was not within easy range for the Luftwaffe. The German commander in Narvik, Gen. (later Col. Gen.) Eduard Dietl, had 2,000 mountain troops and 2,600 sailors, survivors from the sunken destroyers. Beginning on April 14, British and French troops joined the Norwegian 6th Division in a seven weeks' siege that eventually drove the Germans out of Narvik and back to the Swedish border. By the last week in May, Dietl's force faced 24,500 Allied troops, but by then the British and French armies in France were collapsing, and the Allied command had decided to withdraw from Norway. After destroying the port installations at Narvik, the Allied troops began boarding ship on June 4, and the rear guard sailed on June 8.

On June 9, the Norwegian Army command agreed to an armistice, which ended the campaign at midnight that day. Although Norway was not again a scene of active operations, except for Commando-style raids and resistance activity, it remained in the forefront of the war until May 1945. Hitler regarded it as the northern bastion of his Fortress Europe and maintained a 300,000-man army there throughout the war.

See also separate biographies of the leading political and military figures; DENMARK—*History* (World War II); GERMANY—4. *History Since 1850* (Hitler's Third Reich: 1933–1945); NORWAY—*History* (Development Since the Dissolution of the Union); UNION OF SOVIET SOCIALIST RE-

PUBLICS—17. *Foreign Policy* (Aggressive Isolationism: 1939–1941).

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#### 4. Fall of the Low Countries and France

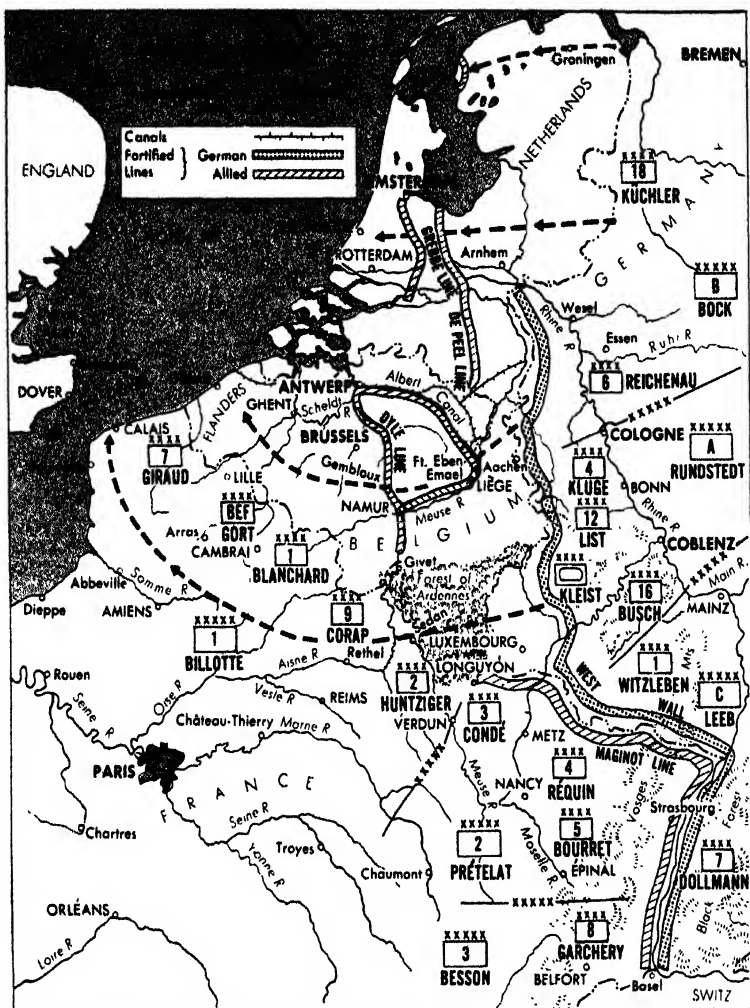
In October 1939, accepting the fact that the conquest of Poland, however impressive, would not prompt Great Britain and France to withdraw from the war, Adolf Hitler directed the High Command of the Armed Forces (*Oberkommando der Wehrmacht* or OKW) to prepare for an offensive in the west. Although the leading German commanders believed the better course to be to await an Allied offensive, he insisted on striking within six weeks in order to forestall further Allied preparations. The first version of the plan for the attack, called *Fall Gelb* (Plan Yellow), was modeled on the old Schlieffen Plan, which had received a modified test in 1914. It was based on a main effort through Belgium north of Liège. A total of 37 divisions was to make this effort, while a subsidiary force of 27 divisions moved through the Ardennes region of Belgium and Luxembourg.

This was exactly what the Allied commanders expected. An attack against northeastern France was improbable because of the existence of the Maginot Line, the formidable belt of fortifications built in the 1930's from Switzerland to Longuyon, near the junction of the borders of Belgium, Luxembourg, and France. Because of the barrier of the hilly, forested Ardennes, Allied commanders considered a major attack there also improbable. Thus only the Liège area, leading to the flatlands of Flanders and thence to France's northern frontier, was supposedly open to the Germans.

Though built originally merely to protect Alsace and Lorraine until France could mobilize against a surprise attack, the Maginot Line had engendered a false sense of security in the war-weary country. French commanders were nevertheless conscious of the great gap reaching from the end of the line to the English Channel. They accepted the fact of the gap on the theory that France could not afford to fight along this line. In the first place, battle in the industrial Lille-Cambrai region would destroy or deny two thirds of the nation's coal resources. Secondly, accepting battle there would mean acquiescence in the surrender of Belgium. This France, victor over Germany in World War I and still a major power with reputedly the world's strongest army, could not accept.

It was apparent to French and British leaders that once the Germans attacked, the Allies had to move into Belgium. To provide time for this movement the Allied leaders depended on a delaying action by the Belgian Army, reinforced by the barrier of the Ardennes and the Meuse River, the large forts at Liège, the deep cut of the Albert Canal north of that city, and Fort Eben-Emael near the Dutch-Belgian border. (This fort was said to be the strongest single fortress in the world.) The major problem was the lack of consultation and coordination with the Belgians and the Dutch. Although the Low Countries realized that Nazi Germany would include them in any pattern of conquest against the West, they continued to hope that a policy of abject neutrality would forestall the inevitable.

The Allies planned nevertheless to advance



Map 5. GERMAN PLAN FOR THE INVASION OF FRANCE AND THE LOW COUNTRIES (May 10, 1940). The Allies expected the coming German offensive to follow the same sweeping path through the Low Countries that the German invasion of 1914 had taken. Accordingly, it was their plan to move into Belgium at the opening of hostilities to reinforce the Belgians at the Dyle Line, and there to stop the German invasion. This time, however, the Germans planned to make their main effort through the difficult but lightly guarded Ardennes area, driving quickly to the English Channel ports, and thus to split the Allied armies and isolate those in the north.

into Belgium to the line of the Scheldt (Escaut, Schelde) River (Plan E). As the months passed without a German attack and the British Expeditionary Force (BEF) was increased to 10 divisions, this plan was replaced by a more ambitious decision to move to the Dyle River, a few miles east of Brussels (Bruxelles). Under Plan D, as the new concept was called, the Belgian Army was to fall back on the Dyle and the lower reaches of the Albert Canal to protect Antwerp (Antwerpen), the British were to defend the upper Dyle, and the French were to hold the Gembloux gap between the Dyle and the Meuse at Namur (Namen) and the Meuse itself where the river crosses the Ardennes. In the continued belief that the main German effort would be made in the Liège area, the supreme French commander, Gen. Maurice Gustave Gamelin, assigned to the Gembloux gap his strongest force, the mechanized First Army under Gen. Georges M. J. Blanchard. The second strongest force, the Seventh Army under Gen. Henri Giraud, ostensibly a reserve, was to move swiftly into the southern Netherlands to assist the Dutch. In keeping with the theory that the Ardennes itself was a considerable barrier, a weaker force, the Ninth Army under Gen. André Georges Corap, was to defend the Meuse from Namur to Sedan;

and another weak force, the Second Army under Gen. Charles Huntziger, was to serve both as a bridge between Sedan and the garrison of the Maginot Line and as a hinge for the wide-swinging movement of the Allied armies into Belgium.

As the Germans prepared for attack in November 1939, an invasion scare gripped the Allies, but bad weather forced postponement of the attack. After repeated postponements because of weather conditions, the attack was firmly scheduled for Jan. 17, 1940. A week before the target date, however, a German plane strayed off its course and was forced down in Belgium. On the two officers aboard the Belgians found orders for the air phase of the invasion. This prompted an alarm of even greater proportions than before, and some French forces began moving toward their assigned sectors along the Belgian border. German observers could not help but note the nature of the French deployment, particularly the weakness of the armies at the hinge near Sedan. Of even greater consequence was the fact that the information gained from the fliers confirmed General Gamelin's view that the invasion was to come through the Liège area and not through the Ardennes.

In the meantime, Hitler and several of his subordinates had begun to question the basic

concept of Plan Yellow. Indeed, even before the November target date, Hitler himself had forced a change in plan that shifted the main effort from north of Liège to both sides of the city. Col. Gen. (later Field Marshal) Gerd von Rundstedt, commander of Army Group A, which was to drive through the Ardennes, insisted that the main effort be made through that sector with armored divisions to the fore. In an audience with the German leader, Rundstedt's chief of staff, Lt. Gen. (later Field Marshal) Erich von Manstein, apparently provided the final arguments needed to change Hitler's mind. After weather again forced the cancellation of the target date, Hitler postponed the offensive until spring and ordered a basic alteration in the plan. Army Group B, in the north, commanded by Col. Gen. Fedor von Bock, was reduced to 28 divisions, only 3 of which were armored. Rundstedt and Army Group A in the Ardennes had 44, including 7 armored divisions. With the main thrust moving via Sedan, Rundstedt was to drive to the channel, trapping French, British, and Belgian armies in Belgium.

Meanwhile, the Allies failed to profit materially from the eight months' respite that they had gained between the declaration of war and the onset of major hostilities in the west. They still felt no real sense of crisis, for they continued to consider the speed of the Polish campaign attributable less to German strength and to a new mode of warfare than to Polish weakness. Although some effort was made to extend the Maginot Line fortifications to the coast, it produced little more than a shallow antitank ditch and a few widely spaced blockhouses. Modern equipment for the French armies and the BEF remained a promise rather than a reality. Allied timetables for troop movements still resembled those of World War I. Corap's Ninth Army, for example, planned on five days for the move to the Meuse covering the Ardennes while only cavalry units sought to delay the Germans east of the river. The Allies, and particularly the French, still looked on tanks as servants of the infantry, parceling them out to infantry divisions rather than massing them in hard-hitting armored formations in close liaison with tactical aircraft.

The Allies actually were superior numerically to the Germans. The French, Dutch, Belgians, and British together had approximately 4,000,000 men available, in contrast to about 2,000,000 Germans who might be used against them. As of May 1940, 136 German divisions were in the west, as opposed to 94 French divisions in north-eastern and northern France, plus 10 British, 22 Belgian, and 9 Dutch divisions. In tanks, too, the opposing forces were relatively equal. The Germans had 2,439 tanks in the west; the Allies, 2,689. Nor were German tanks vastly superior except in speed. Created as infantry support weapons, French tanks were heavily armed and armored but lacked appreciable speed and cruising range. In aircraft the Germans enjoyed some advantage in over-all numbers, with about 3,200 planes to 1,200 French and 600 British planes, but in fighter aircraft alone the two forces were approximately equal. Only in antiaircraft and antitank weapons were the French markedly inferior. The difference in opposing forces thus was less a question of numbers and quality than of a variance in approach to modern warfare. The Germans had developed new methods based on quick breakthroughs by armor supported by

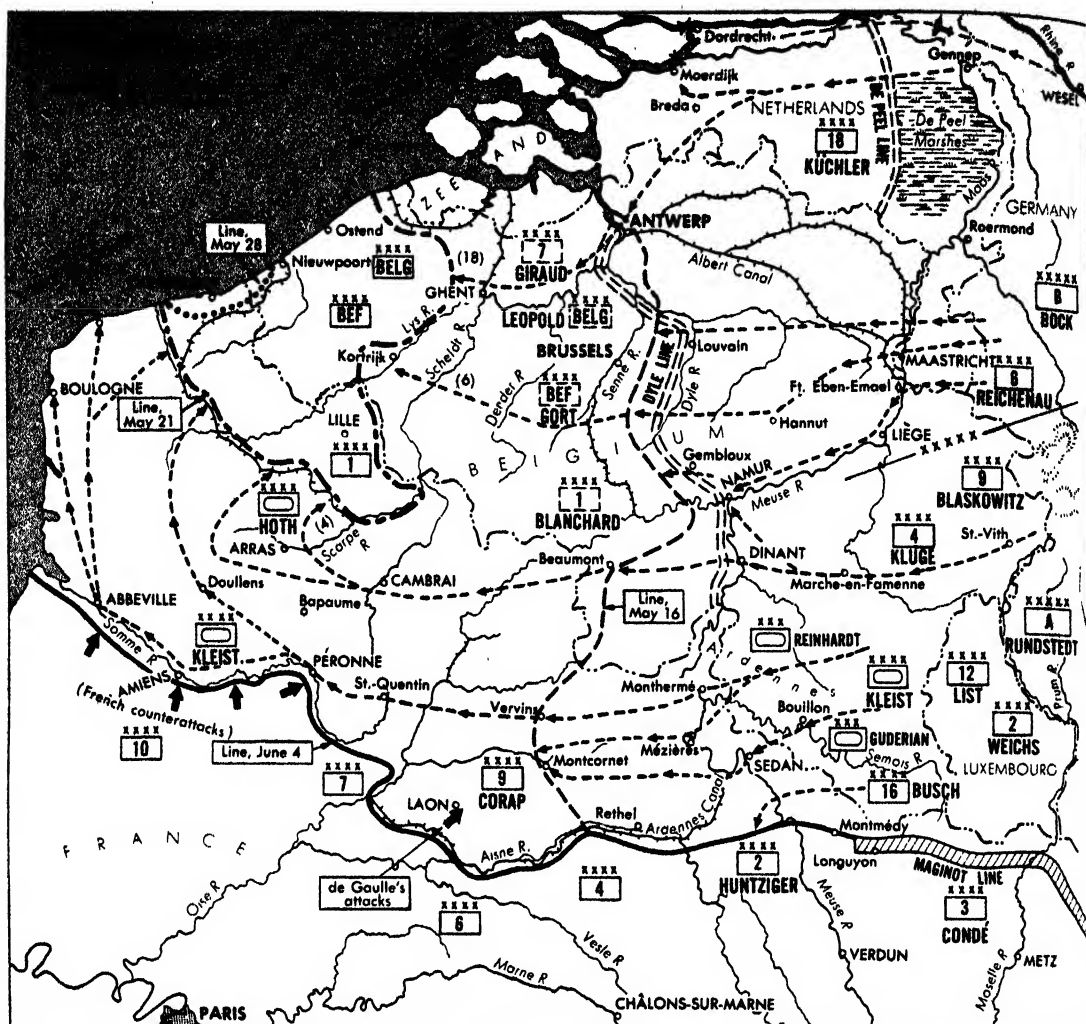
mobile artillery and aircraft, followed by rapid exploitation of the resulting gaps. In addition, a kind of war-weary lethargy still gripped both France and Britain, as is evidenced by their relatively slow industrial mobilization. Not until Hitler invaded Denmark and Norway in April 1940 was the full portent of the Nazi threat accepted in the two nations. By that time it was too late.

**Defeat of the Netherlands.**—It took the Germans only five days to defeat the Dutch Army, a force of about 400,000 men under Lt. Gen. Henri Gerard Winkelman. Before daylight on May 10, parachutists landed near Rotterdam and The Hague. They captured bridges vital to Dutch defensive plans and airfields where reinforcements could be landed from transport planes soon after daylight. There and elsewhere a sizable body of fifth columnists (German nationals or Dutch Nazi sympathizers) aided the invaders. By this daring, revolutionary strike from the air, the Germans in the first blow had pierced the perimeter of the final Dutch defense line, the so-called Fortress of Holland protecting Rotterdam and The Hague. The German Eighteenth Army, led by Gen. (later Field Marshal) Georg von Küchler of Bock's Army Group B, launched the ground attack at dawn, the main column striking through the southern Netherlands to envelop the Dutch south flank. This column captured a railroad bridge across the Maas (Meuse) River intact, forcing the Dutch to relinquish their first line of defense along the river that night.

Beset by German planes, advance guards of the French Seventh Army reached Breda on the second day, May 11, there to try to hold with the Dutch forces that had fallen back from the Maas. Two days later, however, on May 13, the French were forced to retreat toward Antwerp. Meanwhile a German armored division made contact with the airborne troops near Rotterdam. While Queen Wilhelmina and the Dutch government left for England, the remainder of the Dutch Army withdrew into the Fortress of Holland. On the morning of May 14, the Germans warned that if resistance continued, Rotterdam and Utrecht would be destroyed from the air. Two hours before the ultimatum was to expire, the Luftwaffe leveled the business section of Rotterdam, inflicting 30,000 civilian casualties. With the tiny Dutch Air Force wiped out, the nation's final defensive line already breached, and no hope of Allied aid from any source, General Winkelman surrendered late on May 14.

**Onslaught in Belgium.**—Elsewhere in Bock's Army Group B, the Sixth Army under Gen. (later Field Marshal) Walter von Reichenau attacked just before dawn on May 10 to jump the Meuse and the Albert Canal north of Liège and swing southwestward into the Gembloux gap. Taking out the guns of Fort Eben-Emael was essential to the army's progress. In a minutely planned operation, German parachutists and glider troops landed within the fortress and quickly seized key points. The garrison was forced to surrender around noon on the second day, May 11. The line of the Meuse and the Albert thus compromised, the Belgians began to fall back to the Dyle that night under cover of advance contingents of British and French troops. Meanwhile, strong German units advanced on Liège. They occupied the city on May 12, but although they seized a number of the big forts, others held out, the last falling on May 29, though without





Map 6. GERMAN INVASION OF FRANCE AND THE LOW COUNTRIES (May 10–June 4, 1940). The German offensive was conducted as planned and proved surprisingly effective. Though hindered somewhat by the difficult terrain in the Ardennes, German armored forces finally broke through and raced for the Channel coast. With their forces in movement into Belgium and without knowledge of the speed and power of the new blitzkrieg, the Allies could not muster major resistance to the armored thrusts. Such minor counterattacks as could be organized and launched were futile. In less than two weeks, Adolf Hitler's armored forces had reached the coast. There they halted, allowing most of the British and many French troops to be evacuated to England from their entrapment at Dunkerque. By early June, the Germans were prepared for a thrust southward from the Somme-Aisne river line to complete the subjugation of France.

influencing the general course of the campaign.

By May 15, the Sixth Army had been built up against the Dyle Line, while the main column of the Eighteenth Army in the Netherlands swung southwestward against the Belgian left flank near Antwerp. Although the French First Army fought valiantly in the Gembloux gap, by the morning of May 16 French armor had incurred disturbing losses. So strong was the Sixth Army's onslaught against the Dyle Line that the Allies had considerable justification for continuing to believe that the main German effort was in the north. But it would now be only a question of time before Rundstedt's Army Group A, its panzer columns shielded at first by the forests and valleys of the Ardennes, made its full weight felt in the south.

Army Group A controlled six armies, three in line and three in reserve. The northernmost army,

the Fourth under Gen. (later Field Marshal) Hans Günther von Kluge, pointed an armored corps at Dinant. In the center an armored force called Panzer Group Kleist after its commander, Gen. (later Field Marshal) Ewald von Kleist, was the equivalent of an army with two armored corps and a follow-up corps of 5 motorized divisions. The corps in the north under Gen. Hans Reinhardt had 2 armored divisions aimed at the Meuse around Monthermé; the other, with 3 armored divisions under Gen. (later Col. Gen.) Heinz Guderian, was aimed at Sedan. South of Panzer Group Kleist the Sixteenth Army under Gen. (later Field Marshal) Ernst Busch was to cover Kleist's south flank east of the Meuse. Once Kleist achieved his penetrations, three other armies were to move forward to protect the south flank of the drive to the sea.

On the French side the error of the high com-

mand in placing two mediocre armies in the Ardennes sector against what was to be the main German effort was compounded by the dispositions ordered by the army commanders. General Huntziger (Second Army) put his strongest divisions in the Maginot Line; his weakest (newly mobilized reservists), along his left boundary near Sedan. General Corap (Ninth Army) put his two weakest divisions along his right boundary near that city. Thus the main German thrust of Kleist's armor was destined to strike not only the two weakest French armies but their weakest portions as well.

As Rundstedt and his subordinate commanders learned on May 10, there was some reason for the French theory that the Ardennes is a difficult barrier for major attacks. It took all of the first day for the armor to cross the undefended northern portion of Luxembourg. Yet on the second day the columns picked up momentum, and the cavalry of the Belgian *Chasseurs Ardennais* and of Corap's Ninth Army could do little to stay the German tanks. French aircraft were absent, preoccupied with the presumed main effort in the Gembloux gap. By nightfall of May 11, Guderian's columns had reached Bouillon, on the serpentine Semois River only a few miles from Sedan. Although a blown bridge forestalled further advance for the night, the armored corps forced a crossing early the next day, and by nightfall it overlooked the great loop in the Meuse at Sedan that had played a vital role in the defeat there in 1870 of the army of Napoleon III. Meanwhile, Reinhardt's armor reached the Meuse near Monthermé and Mézières, north of Sedan. Although both Reinhardt and Guderian prepared to cross the Meuse on May 13, the honor of the first bridgehead fell to the 7th Panzer Division of the Fourth Army, under the command of Gen. (later Field Marshal) Erwin Rommel. A column of the division reached the Meuse at Dinant on the evening of May 12, narrowly missed taking a railroad bridge intact, and then sent a patrol across during the night over an old dam or weir. Under concealment of a fog soon after daylight on May 13, reinforcements crossed in rubber assault boats. Night fell with Rommel holding a bridgehead a mile deep.

Neither Guderian nor Reinhardt had yet built up sizable forces for an assault crossing of the Meuse near Sedan, but an attack was ordered for the afternoon of May 13 in the hope of catching the French before they were prepared for it. To compensate for the absence of heavy artillery, hundreds of fighters and Stuka dive bombers began to bomb and strafe French positions four hours before the assault began. Confronted with this terrifying new departure in warfare, some of the defending French reservists panicked. Nevertheless, the French made their enemy pay dearly in the actual assault. Artillery and machine guns cut down half of the German troops, but the other half got across the river. Three out of four attempted crossings succeeded, and by midnight a pontoon bridge spanned the Meuse. The next day, May 14, General Huntziger hastily counterattacked Guderian's south flank with a cavalry division, though without appreciable success. Guderian's 2d Panzer Division plunged on to the west, seizing two bridges intact across the Ardennes Canal. The spectacular drive from the Meuse to the Channel coast had begun.

In the meantime, Reinhardt's armored corps had greater difficulty. French artillery and small-

arms fire beat back two crossing attempts at Mézières and Monthermé. Not until almost nightfall, after tanks had arrived to deliver point-blank fire across the river, was a crossing achieved, and then only at heavy cost. All through the next day, May 14, the status of the bridgehead remained in doubt as the French mustered local reserves against it, but by the morning of May 15 Reinhardt's engineers had put in a pontoon bridge, and reinforcements poured across it. The French fallacy in failing to establish defenses in depth then became painfully apparent: by evening advance contingents of Reinhardt's armor were 35 miles beyond the Meuse, close to Guderian's flank. Army Group A had made a gap 50 miles wide in Second and Ninth Army positions. The breakthrough was complete.

**Drive to the Channel.**—The breakthrough in the south seriously jeopardized the main Allied forces in Belgium. The French Seventh Army on the extreme left had already lost some of its advance contingents in the Netherlands, and others retreated to the island of Walcheren between Antwerp and the sea (there to hold until May 17), while late on May 14 what remained of the army began to move southward under orders from General Gamelin to try to reinforce Corap's Ninth Army. The next day, Gamelin replaced Corap with the Seventh Army commander, Giraud. Meanwhile, the Belgians and the British were not particularly hard pressed in their positions behind the Dyle, and the French First Army at a continuing heavy cost in casualties maintained its positions in the Gembloux gap. In view of the breakthrough to the south, however, none of this mattered much. In midmorning of May 16, Gen. Gaston Henri Billotte, the army group commander in Belgium, ordered a withdrawal to the Scheldt River, the line originally contemplated in Plan E.

In the meantime, the French High Command had tried to muster reserves to eliminate the armored penetration near Sedan. There was a frenzy of improvisation—a division ordered here, another there, 7 divisions pulled out of the Maginot Line, the Second Army ordered to attack northward, the First Army ordered to attack southward—but none of it bore directly on the realities of the situation. In almost every case the scheduled times of counterattack showed that the French generals still failed to appreciate the speed of the new type of warfare. The only two counterattacks of any consequence were launched northeast of Laon by a newly created armored division, the 4th, under a general of brigade, Charles de Gaulle, who in the 1930's had raised one of the few voices urging French adaptation to the methods of armored warfare. Although de Gaulle gained initial successes on May 17 and May 19, he could not hold the positions he won without help.

Moving with impressive speed, Kleist's armor on May 18 took St.-Quentin, halfway to the Channel from Sedan, and by the end of the day had reached Péronne. The next day the tanks reached Amiens and Doullens, 40 miles from the coast. On May 20, Abbeville fell, and for all practical purposes German armor faced the Channel. The British line of communications, which had been based on Cherbourg and the Brittany ports in deference to German strength in the air, was severed. In 11 days the Germans had driven from the eastern frontier of Luxem-

bourg to the coast, a distance of more than 240 miles.

Allied attempts to stem the onrush north of the German penetration were almost as futile as the French efforts from the south. Although the BEF withdrew in good order to the Scheldt, arriving at the river during the night of May 18, the situation on both flanks had begun to disintegrate. K  chler's Eighteenth Army hammered the Belgians in front of Antwerp relentlessly and took the city on May 18. By May 21, the Belgians were back on the Lys River protecting Ghent (Gent). Although the French First Army held a salient extending southeast of Lille, the fact that the Ninth Army had collapsed (the new commander, Giraud, was captured on May 18) left the French right flank and thus the British rear unprotected. The next day the BEF commander, the 6th Viscount Gort, created two makeshift commands, each somewhat larger than a brigade, as a first step in forming a so-called canal line from the Channel near Dunkerque to the vicinity of Arras.

Short of an attempt to withdraw across the Channel, the only hope for the Allies appeared to lie in cutting the German penetration and thereby establishing a firm line from the Somme to the Scheldt. This General Camelin ordered late on May 19, only a short while before the French government relieved him of command. The new supreme commander, Gen. Maxime Weygand, canceled the order pending consultation with the commanders in the pocket. Flying to Calais on May 21, Weygand talked with King Leopold III of the Belgians and with General Billotte, the army group commander, but he failed to see Lord Gort, who was delayed en route to the meeting. After ordering a combined British-French attack toward Bapaume and Cambrai with 8 divisions, to be met by a French attack northward across the Somme, Weygand departed. While returning from the conference, Billotte was killed in an automobile accident. Although Weygand ordered General Blanchard to fill the post of group commander, Billotte's death combined with Camelin's relief and Weygand's delay to deprive the forces in the pocket of strong central command for three critical days when a coordinated counterattack to the south might have succeeded.

Under orders from his government, Lord Gort had already attempted one counterattack on May 21. With the promise of considerable help from the French First Army, he intended to

drive southward from Arras, but as the French assistance materialized, it amounted to only 60 tanks, and unremitting German pressure forced the diversion of a substantial part of the British troops. The counterattack failed even to reach the first day's objectives a few miles below Arras, and as night fell, Gort pulled the troops back to Arras and the canal line. The next day, May 22, as the First Army mustered 2 divisions to counterattack, Gort was too hard pressed on his two fronts, the positions on the Scheldt and the canal line, to give any help. Although the French divisions almost reached the outskirts of Cambrai, German dive bombers forced their withdrawal. The French in the south then mounted an attack on May 23, but it failed even to cross the Somme. For all practical purposes, this ended the efforts to link the troops in the pocket, which still totaled 40 divisions, with the main French armies in the south.

**Retreat to Dunkerque.**—With the collapse of these measures, the forces in the pocket appeared doomed. Boulogne was about to fall, and Calais was under siege, leaving Dunkerque (q.v.) as the only port. German armor had already forced one crossing of the canal line, and a rapid thrust to cut the Allied troops from the sea seemed likely. Then, abruptly, the German armor came to a halt. In later years some German commanders tried to place full responsibility for the decision to halt the armor on Hitler, but contemporary records appear to indicate that even if the decision was Hitler's, the impetus for it came from Rundstedt. By May 23, Rundstedt's tanks had incurred 50 percent losses, and the terrain beyond the canal line, crisscrossed by waterways and flooded lowlands, was unattractive for armor. Furthermore, heavy tank losses at this stage would seriously endanger the pending attack southward across the Somme into the heart of France. In the early evening of May 23, Rundstedt ordered his armor to halt, ostensibly to reorganize before moving against the canal line. The next morning, however, after a conference with Rundstedt, Hitler sanctioned stopping the armor altogether and leaving the mopping up to the infantry divisions.

At almost the same moment a new threat developed from another direction against the forces in the pocket. On either side of Kortrijk (Courtrai) on the Lys River, Bock's Army Group B opened a major attack against the Belgians. Despite help rushed by the British and the French, the Belgian Army began to give way



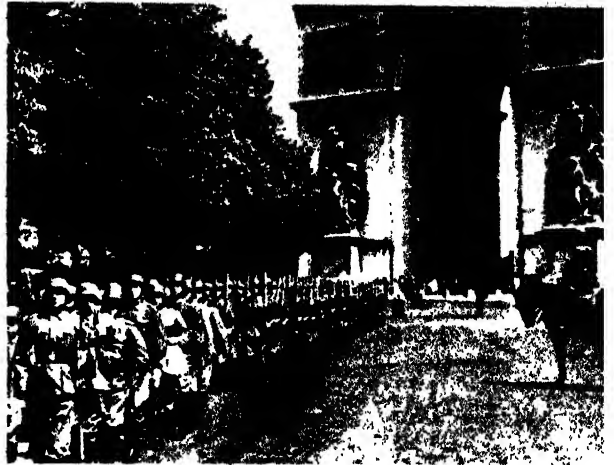
In June 1940, British troops wait in a queue on the dunes of Dunkerque to board small boats and be ferried to large vessels offshore.

The Times, London

on May 26. Concluding that his forces were too depleted and embattled to break away for withdrawal to the Yser River, King Leopold on the next day sent an emissary to the Germans to ask the terms of an armistice. Though the terms were unconditional surrender, he deemed that he had no choice but to accept, and the army surrendered on May 28. Anticipating the Belgian collapse, the British government, in the early evening of May 26, had authorized Lord Gort to withdraw the BEF to England. The French Command authorized one of three French corps to participate in the withdrawal, but the other two corps of 6 divisions, closely engaged near Lille, fought on until they were surrounded, eventually surrendering on June 1.

The withdrawal to a shallow perimeter based on canal and river lines around Dunkerque began the night of May 27 and continued through the next day. The embarkation maneuver, called Operation Dynamo, began officially on May 27. A disappointing 7,669 men were embarked that day, but the tempo of the operation picked up thereafter. A total of 848 British, Dutch, Belgian, and French ships of all sizes from destroyers and Channel ferries to fishing smacks and private yachts plied the rough waters of the Channel under the cannon and bombs of the Luftwaffe and the guns of coastal batteries for eight days and nights. They removed from the harbor of Dunkerque and nearby beaches 338,226 men, two thirds of them British.

**Fall of France.**—While these dramatic events occurred in the north, the French south of the German penetration were attempting to build a new line generally along the Somme and Aisne



Bibliothek für Zeitgeschichte, Stuttgart

Paris fell to the Germans on June 14, 1940. Here, in front of the Arch of Triumph, a company of occupation troops marches on guard duty.

rivers. Known as the Weygand Line, the new positions emphasized defense in depth in the hope of sealing off German penetrations and permitting prompt local counterattacks. With his forces reduced by half, General Weygand concentrated his greatest strength in the coastal sector, where he expected the Germans to strike for the ports to deny aid from Britain, and on the plain of Champagne east of Reims, which

**Map 7. FALL OF FRANCE** (June 5-25, 1940). Gen. Maxime Weygand strove desperately to organize a defense behind the Somme and the Aisne, but he had insufficient forces to stem the overwhelming power of the German offensive. The crisis came on June 12, when Gen. Heinz Guderian's armor broke through the line at Châlons-sur-Marne and raced toward the Swiss border, which it reached on June 17, trapping the 500,000 Frenchmen in the Maginot Line. Thereafter, organized resistance collapsed. Paris fell on June 14; by June 25, the German advance had reached the line shown. Benito Mussolini had joined Adolf Hitler in the war on June 10, and pressed the French in the south. Fighting stopped on June 25, after the French had signed armistices with the Germans and the Italians.



offered ideal ground for tanks. He had correctly divined the German intentions, but the entire Somme portion of the new line was weak from the outset because of German bridgeheads established during the dash to the sea. On June 5 and June 6, Bock's Army Group B launched what was considered the secondary effort northwest of Paris. Although the French fought with bitter determination, fresh German units soon made the difference. By nightfall on June 8, Bock had achieved a decisive breakthrough. As the French northwest of Paris fell back, they compromised the left flank of the armies on the Aisne. Here, where Rundstedt's Army Group A launched the German main effort on June 9, gains for the first three days were meager, and even small gains came under immediate French counterattack. Then, on June 11, the French were forced to fall back behind the Marne in deference to their open flank. The next day, as four armored divisions under Guderian broke through, the fate of France was sealed.

Meanwhile, Benito Mussolini's Fascist Italy declared war on France and Great Britain on June 10. As the French government declared Paris an open city and withdrew, first to Tours and then to Bordeaux, the Germans entered the capital on June 14. On the same day, Army Group C, commanded by Gen. (later Field Marshal) Wilhelm von Leeb, began to attack the Maginot Line and achieved two quick penetrations against a garrison minus its mobile reserves. On June 17, Guderian's tanks reached the Swiss border, cutting off the 500,000 French still in the big forts.

As Premier Paul Reynaud considered the possibility of withdrawing the government to North Africa to continue the war, Prime Minister Winston Churchill encouraged him on June 16 with an offer of "indissoluble union" with Britain, but a majority of the cabinet voted to request armistice terms. On June 17, the aging World War I hero, Marshal Philippe Pétain, heading a new government, asked for an armistice. In the early minutes of June 25, the six-week ordeal ended. France lay prostrate, beaten in a 42-day campaign that stunned the world.

German casualties in the campaign were comparatively light, approximating 156,000, including 27,000 killed and 18,000 missing. The British incurred 68,000 casualties, plus the loss of almost all their weapons and equipment. The French have estimated that they lost 123,600 men killed, missing, and captured and 200,000 wounded. The Germans claimed 1,500,000 prisoners, a not unlikely figure in view of wholesale French surrenders between Pétain's request for an armistice and the final cease-fire.

**Battle of Britain.**—Britain stood alone, protected only by the Royal Navy, the moat of the Channel, an army almost devoid of guns, 59 Royal Air Force (RAF) fighter squadrons, and grim determination. While the German armies were defeating France, Hitler directed preliminary planning for the invasion of Britain (Operation Sea Lion). It soon became apparent that the defeat of the RAF was a vital preliminary to any invasion attempt. Although the Luftwaffe initiated strikes against coastal shipping early in July, it was the end of the month before the necessary bases could be built up in France and the Low Countries for the air offensive to begin in earnest. In an air battle that lasted until the end of October, the German object throughout



Imperial War Museum, London

During the heavy German air raids of November 1940, Londoners take shelter in the Underground. Here a group spends the night in the Elephant and Castle station.

was to destroy RAF fighter strength, thus providing a free field for German bombers. To achieve this goal the Luftwaffe concentrated primarily against ports and shipping until August 12, and from August 13 to September 6 against airfields and aircraft factories.

As had been proved in the skies above Dunkerque, the British Spitfire fighters were superior to the German mainstay, the Messerschmitt 109, in maneuverability and armament and at least its equal in speed. Moreover, the Germans had to contend with the valor of British pilots and the efficiency of British radar and ground defenses. In the first phase of the battle, German fighters flew from 5,000 to 10,000 feet above their bombers; this enabled part of the RAF fighters to make a holding attack against the German fighters while the others struck at the bombers. In the second phase the Luftwaffe switched tactics to provide fighter cover at lower levels, but the British countered by intercepting the attackers farther out. In both phases the RAF inflicted disproportionately heavy losses on the Luftwaffe. On August 16, for example, the Germans lost 144 of 1,000 planes, while the British lost only 18. Unrealistic claims by Luftwaffe pilots soon confused the Luftwaffe command: on August 16, the pilots erroneously claimed 65 British planes. When this led to the inevitable assumption that the RAF's first line of defense had been broken, the Germans switched on September 7 to inland targets, including cities, in the hope of bringing to battle RAF reserves. Thus began the large-scale raids on cities like London and Coventry, which inflicted heavy damage and high civilian casualties but did little to change the ratio of British and German losses in planes.



By September 12, continued heavy air attacks and a concentration of barges in Belgian and French ports convinced many persons in Britain that invasion was imminent. Actually, no invasion was ever ordered or attempted. On September 17, Hitler tacitly admitted defeat in the Battle of Britain by postponing the invasion indefinitely. During the last week of September continued high German losses brought an end to large-scale daylight raids. As the Luftwaffe turned to night attacks, mainly against London, the battle took on the aspects of a siege. Although air attacks would continue through much of the war, the Battle of Britain per se was over by mid-October as Hitler turned his attention toward the Balkans and the Soviet Union.

In the Battle of Britain the RAF lost a total of 790 fighters; the Luftwaffe, 1,389 planes of all types. As an indication of the thin margin on which the RAF operated, there were only 570 Hurricanes and Spitfires on hand at the height of the battle. "Never in the field of human conflict," said Churchill, "was so much owed by so many to so few." Britain had stood alone, and Britain had won.

See also section 13. *Developments in Air Warfare*; separate biographies of the leading military and political figures; BELGIUM—5. *History* (Belgium in World War II); FORTIFICATIONS—*Permanent Fortifications* (Modern Fortifications); World War II; FRANCE—31. *History: The Third Republic, 1870–1940* (Crisis and Collapse); LUXEMBOURG—*History*; NETHERLANDS—*History*

(Development Since World War I).

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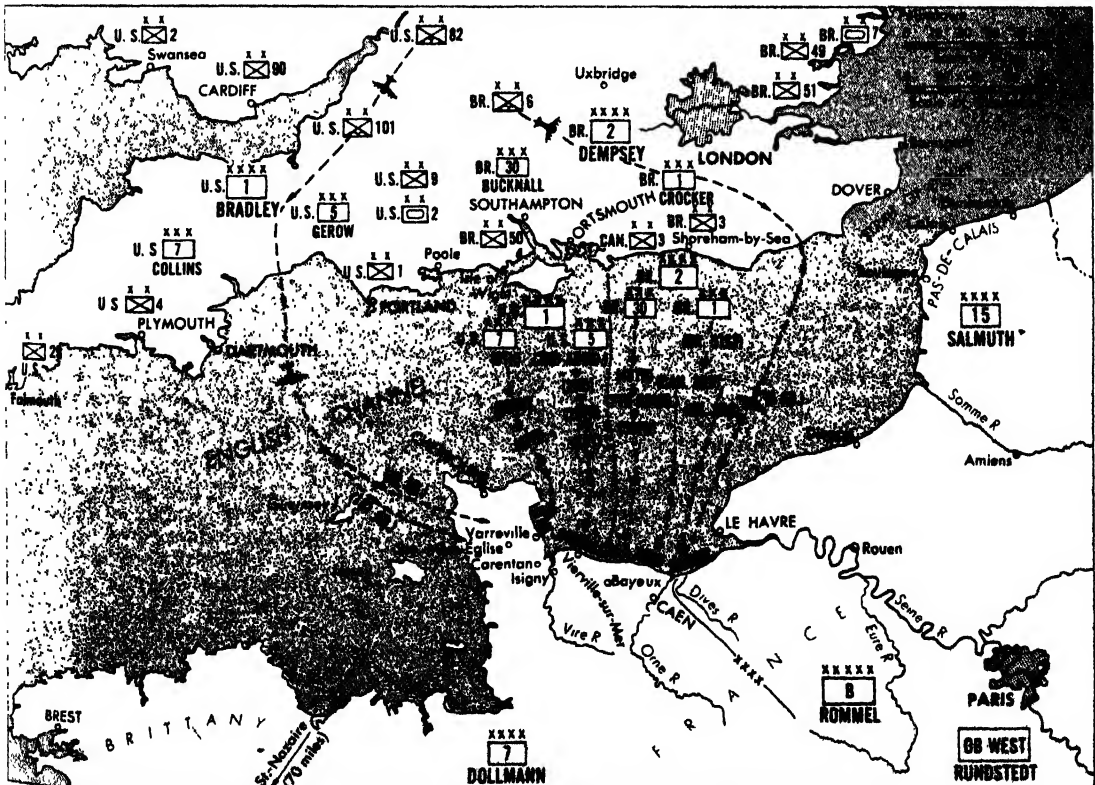
## 5. Recovery of France and Advance into Germany

### PLANS FOR THE ALLIED INVASION OF FRANCE

Even though military resources in Britain were meager after the withdrawal from France in 1940, British forces soon began to plan a return to the Continent. In September 1941, the British Chiefs of Staff charged Adm. Lord Louis Mountbatten (later 1st Earl Mountbatten of Burma), who headed the Combined Operations Headquarters, with investigating the technical problems of amphibious operations. Not long afterward the British joint planners drew up the first formal plan for a cross-Channel attack. This plan, which was called Roundup, assumed a marked deterioration of German strength. Projecting the use of relatively small British forces, it was designed to disrupt German withdrawal to the homeland in the final phase of the war.

Though American military officers were in England as observers as early as October 1940, the World War II alliance between the English-speaking nations began to take definite shape only in January 1941. This was the month when American and British military officers met in Washington for conversations that became known as ABC-1. The agreements reached—that the two nations were to maintain joint planning staffs in

Map 8. THE ALLIES RETURN TO FRANCE (June 6, 1944). The map shows the concentration areas of the invasion forces in England, their organization for the invasion, the beaches at which the five assault forces were to land, and the air-borne operations to be conducted in support of the amphibious assaults.



Washington and London and that, if forced into war with both Japan and Germany, the United States would join Britain in defeating Germany first—started the chain of events that led to the eventual cross-Channel invasion and victory in Europe. It was two months later, in March, when Congress passed the Lend-Lease Act, which authorized the United States to provide war materials for nations under Axis attack. By June, with the American observers in London having become the Special Observer Group and the British having sent representatives to Washington, the two countries were in close liaison. Though the United States still was not at war, American troops replaced British troops in Iceland in July 1941, and later in the summer began to construct naval and air bases in the United Kingdom, ostensibly for British use.

**Developing Alliance.**—Immediately after the Japanese attack on Pearl Harbor and the German declaration of war against the United States, as American and British military leaders met in Washington in a series of conferences known as Arcadia (December 1941–January 1942), they reaffirmed the ABC-1 decision to remain on the strategic defensive in the Pacific while defeating Germany first. They decided to wear down German resistance in 1942 by air bombardment, by assisting the USSR, and by trying to gain the entire North African coast, before initiating in 1943 a large-scale land offensive against Germany across either the Mediterranean Sea or the English channel. They also created the Combined Chiefs of Staff (CCS), consisting of the United States Joint Chiefs of Staff and the British Chiefs of Staff, as the body to assist and advise President Franklin D. Roosevelt and Prime Minister Winston Churchill on the direction and conduct of the war. The most prominent members of the CCS were Gen. (later General of the Army) George C. Marshall, United States Army chief of staff, and Gen. (later Field Marshal) Sir Alan F. Brooke (later 1st Viscount Alanbrooke), chief of the Imperial General Staff. Because the CCS met only periodically, the American and British members did the detailed work of planning separately. Those most concerned with planning a European invasion were the Operations Division (OPD) of the United States War Department and the British Combined Commanders (the senior ground, naval, and air officers, together with Lord Mountbatten).

Differences between the Allies in general strategic outlook soon became apparent. The British, acutely conscious of the difficulty of a Channel crossing, aware of the need for special boats and equipment, and impressed by the strength of the German Army, favored a peripheral strategy, including ground operations in the Mediterranean or in Scandinavia and such indirect methods of attack as blockade, air bombardment, and the encouragement of subversive activities in German-occupied countries. Only when the Germans had been weakened to the point where an invasion would be sure of success was a cross-Channel attack to be launched. The Americans, more conscious of the needs of the Pacific war, and therefore impatient for victory in Europe, rejected the peripheral areas for major operations, for they believed that only by a showdown in northwestern Europe could the Germans be beaten.

As the first American ground troops (34th Division) arrived in Northern Ireland in January

1942, the Special Observer Group was redesignated the United States Army Forces in the British Isles. Not long afterward, United States air force contingents began to arrive in England for eventual participation in the bombardment of German-held Europe, and in July American air crews in borrowed Royal Air Force (RAF) planes flew their first mission, a daylight attack against German airfields in the Netherlands. Then, in August, the Eighth Air Force, commanded by Maj. Gen. (later Gen.) Carl Spaatz, carried out the first bombing of Europe by American pilots flying American planes.

Because the Americans still were building up their strength and because British resources were hardly sufficient to carry out a cross-Channel attack alone, the British chiefs concluded that no cross-Channel operation was feasible in 1942 unless Germany showed unmistakable signs of collapse. Even 1943 remained doubtful. In March 1942, the OPD nevertheless began work on an outline plan for a full-scale invasion of Europe in 1943. The following month, General Marshall and Harry Hopkins, confidential adviser to President Roosevelt, went to London to try to gain British acceptance of the idea. The British agreed not only with the concept but also with a War Department proposal, code named Bolero, for a great buildup of American forces in Britain, with approximately 1 million men to be equipped and trained to carry out air operations in 1942 and a major invasion of the Continent in 1943. To implement the decision, Maj. Gen. (later Lt. Gen.) John C. H. Lee arrived in the United Kingdom in May to activate the Services of Supply. On June 24, Maj. Gen. (later General of the Army) Dwight D. Eisenhower arrived to take command of the European Theater of Operations, United States Army (ETOUSA).

Approval of the 1943 invasion—landings on a wide front between Boulogne and Le Havre, or Roundup, as it was called—did not solve the problem of what to do in 1942. That summer, President Roosevelt became increasingly convinced of the need for active operations in the European area before the end of the year. The commencement of a new German offensive in the USSR in June and British reverses in North Africa had their effects on his thinking. Fortunately, two decisive naval victories over the Japanese in May and June (Coral Sea and Midway) relieved the immediate threat to Australia and made it possible for the United States to divert greater resources to Europe. Despite the recommendations of General Marshall and Adm. (later Admiral of the Fleet) Ernest J. King, United States chief of naval operations (both of whom considered a North African venture a dispersal of strength), Roosevelt accepted a British proposal to invade North Africa that year (Operation Torch). The CCS appointed Eisenhower to assume immediate control of the planning. The decision to invade North Africa placed the Bolero-Roundup concept in jeopardy. Though planning for an eventual cross-Channel operation continued, Torch absorbed almost the entire effort and attention of the Allies in the European area. The invasion on Nov. 8, 1942, and the subsequent campaign through the winter and spring drained men, matériel, and supplies from the American buildup in the British Isles.

Meanwhile, the British had executed two daring raids against the German-held French coast. In March 1942, specially trained troops

called **Commandos** launched a hit-and-run foray against St.-Nazaire and destroyed submarine pens and other naval facilities. In August, a joint British and Canadian command, with 5,000 Canadians, 1,000 British, and 50 United States Rangers, raided Dieppe in a miniature invasion to test amphibious tactics and techniques. Involving the full use of combined arms and the mass landings of infantry and armor to seize a beachhead, the Dieppe operation was designed not to hold a beachhead but rather to test the ability of the newly developed LCT (landing craft, tank) to land tanks across beaches, to see whether it was possible to capture a port in a frontal assault, to scrutinize the organization of air forces for overhead cover and support, and to test the naval management of a considerable invasion fleet. Of the 6,100 troops embarked for Dieppe, about 2,500 returned, including about 1,000 who never landed. The others were killed or captured.

**Plans Developed.**—When the CCS met at Casablanca in January 1943, it was a time of optimism. The Germans had been decisively defeated in North Africa, though the campaign would continue until May. The Russians had taken the offensive after stopping the Germans at Stalingrad (now Volgograd), and Japanese expansion in the Pacific had definitely been checked. As a consequence, the greatest obstacle blocking offensive operations against the European continent that year was the relative paucity of Allied resources, particularly the shortage of shipping due to the effectiveness of German submarine warfare.

To make the Mediterranean safe for shipping, the Allies at Casablanca decided to invade Sicily after completing the conquest of the North African shore. By seizing Sicily, they hoped also to remove Italy from the war. To increase pressure on Germany, they agreed to initiate intensified air attacks from the United Kingdom, called the combined bomber offensive (Operation Pointblank). But for a major invasion across the Channel in 1943 the Allied leaders judged their resources insufficient. Though they set up a combined command and planning organization, it was designed to plan for small-scale raids and a return to the Continent in 1943 only if the Germans collapsed. A full-scale invasion was reserved for 1944.

Studying the Dieppe experience, the CCS planners concluded that the strength of the enemy defenses along the Channel coast required an immense concentration of power in the initial assault. Instead of dispersed landings, instead of many separate assaults by regimental and Commando units, it was better to make a single main landing. The beachhead initially secured should then be expanded and developed into a lodgment for the entire invasion force scheduled to follow. The area of initial assault and subsequent lodgment had various requirements. It had to be within range of fighter planes based in the United Kingdom; it had to provide airfields and sites suitable for constructing airfields soon after the invasion; it had to have at least one major port; and the landing beaches had to be sheltered from winds, suitable for prolonged maintenance operations, provided with adequate exits, and backed by good road nets. Furthermore, naval shelling, air bombardment, or airborne landings would have to be capable of reducing or crippling the beach defenses. The area most appropriate

for initial landings, the planners decided, was the Channel coast of France between Caen and Cherbourg.

When the CCS approved this analysis on March 1, 1943, they transmitted it as the basic paper for cross-Channel planning to Lt. Gen. (later Sir) Frederick E. Morgan, a British officer appointed that month as chief of staff to the supreme Allied commander (COSSAC). In a subsequent directive issued on April 23, the CCS instructed Morgan to set up an Allied headquarters for the supreme commander, who had yet to be named, and to plan to invade northwestern Europe as early as possible in 1944. Meanwhile, in February 1943, General Eisenhower, the supreme Allied commander in the Mediterranean, had relinquished command of ETOUSA, with its headquarters in England, to Lt. Gen. Frank M. Andrews. In May, when Andrews died in an air accident, Lt. Gen. (later Gen.) Jacob L. Devers took his place.

In May 1943, at the Trident Conference in Washington, the CCS enlarged the Allied bomber offensive from the United Kingdom, decided to exploit the projected Sicily operation to ensure the elimination of Italy from the war, and set a target date for a cross-Channel operation on May 1, 1944. In the future, men, matériel, and supplies were not to be diverted from the Bolero buildup for Mediterranean operations; on the contrary, 7 Allied divisions were to return from the Mediterranean area to the United Kingdom. The Allies visualized 29 divisions available for the invasion of France by the spring of 1944.

The reason for this optimistic estimate was the success of Allied warships and planes in destroying a growing number of German submarines during the spring of 1943. The decrease in shipping losses, combined with an increase in shipyard production and the freeing of resources in the Mediterranean, made possible a tremendous buildup of American forces in the United Kingdom. It was predicted that 1,300,000 United States troops (400,000 air force and 900,000 ground combat and service troops, including more than 18 combat divisions) would be in the United Kingdom by May 1944.

During the summer of 1943, COSSAC formulated three plans: Cockade, essentially a deception operation designed to pin German forces down in the west by encouraging their expectations of an Allied invasion that year; Rankin, a blueprint for occupying the Continent in case of a sudden German collapse; and Overlord, an invasion in the Caen-Cotentin area with an initial assault of from 3 to 5 divisions. In reality a concept to be used as the basis for later detailed planning, Overlord accepted the risk of prolonged beach maintenance by depending on the development of two prefabricated ports (code named Mulberries) to be towed across the Channel during the invasion. Under Overlord the initial mission of the invasion forces was to gain a lodgment area between the Seine and Loire rivers in France. As increasing numbers of combat units entered the lodgment area, ports, airfields, and supply installations would be developed and organized to support a subsequent drive toward Germany.

The planners assumed that it would take three months to secure lodgment. They then expected a pause for logistical reasons before an advance could be made beyond the Seine. Because they anticipated that the Germans would destroy the

facilities of Cherbourg and Brest, they thought of developing a major port of entry for United States forces on the south shore of Brittany at Quiberon Bay (Operation Chastity).

The Allied conquest of Sicily (July–August 1943), the fall of Benito Mussolini (July 25), negotiations for the surrender of Italy (eventually announced on September 8), and preparations for an Allied invasion of the Italian mainland (to be initiated on September 3), together with the Soviet seizure of initiative on the eastern front, provided a bright background for the CCS meeting at Quebec in August 1943. Though the CCS accepted COSSAC's Overlord concept, the debates between the Allies demonstrated divergent points of view. The British espoused a strategy essentially opportunistic, a view that reemphasized peripheral operations aimed at reducing German power by indirect attack (increased air and sea operations, plus intensified ground operations in the Mediterranean) in order to make the cross-Channel attack a success without question. They favored leaving the timing of Overlord somewhat indefinite. The Americans, wanting a power thrust to be made as quickly as possible, urged a definite commitment for Overlord, preferably May 1. The result was a compromise. Though May 1 remained the target date, it was not an altogether firm commitment. Yet the Allies agreed to give Overlord strict priority over operations in the Mediterranean. Accepting COSSAC's wish for a diversionary invasion of southern France, the CCS instructed General Eisenhower to draw plans for an operation to be executed from Mediterranean resources, timed to coincide with Overlord, and designed to gain lodgment in the Toulon-Marseille area, with a subsequent exploitation to the north and a juncture with the Overlord forces.

**Selection of Commanders.**—Selecting a supreme commander for the cross-Channel invasion was no easy matter. When an invasion in 1943 had seemed possible and the bulk of the resources would have been British, Churchill had informed General Brooke that he was to command the invasion forces. Later, when the preponderance of American resources dictated the choice of an American commander, Roosevelt and the British as well inclined toward General Marshall. But because Roosevelt wished Marshall to remain in control of the over-all American effort (Marshall was invaluable in balancing the sometimes conflicting demands of the Pacific and European theaters), the president, in December 1943, appointed General Eisenhower supreme commander of the Allied Expeditionary Force. Eisenhower's chief of staff, Lt. Gen. (later Gen.) Walter Bedell Smith, transformed the COSSAC staff into the Supreme Headquarters, Allied Expeditionary Force (SHAEF), with General Morgan remaining as deputy chief of staff. Eisenhower assumed his new position on Jan. 16, 1944, and General Devers was transferred to North Africa as commander of United States forces in the Mediterranean.

Gen. (later Field Marshal) Sir Bernard Law Montgomery (later 1st Viscount Montgomery of Alamein), who had led the Eighth Army in North Africa, Sicily, and Italy, was at the same time named to command the Twenty-first Army Group, the supreme British headquarters for the invasion. Eisenhower directed Montgomery to act as ground force commander during the initial phase of the invasion but reserved for himself the

eventual control of the Allied land forces. The major ground commanders were Lt. Gen. (later Gen.) Sir Miles C. Dempsey, who commanded the British Second Army; Lt. Gen. (later Gen.) Henry D. G. Crerar, in command of the Canadian First Army; and Lt. Gen. (later General of the Army) Omar N. Bradley, who took command of the United States First Army and of the United States First Army Group (later renamed the Twelfth Army Group). Lt. Gen. (later Gen.) George S. Patton, Jr., placed in command of the United States Third Army, was to head the immediate American follow-up force.

Eisenhower's deputy commander, Air Chief Marshal Sir Arthur W. Tedder (later 1st Baron Tedder), acted as coordinator of the air forces; the tactical air forces organized under Air Chief Marshal Sir Trafford L. Leigh-Mallory, who commanded the Allied Expeditionary Air Forces (AEAF); and the strategic air forces, composed of the RAF Bomber Command, under Air Chief Marshal Sir Arthur T. Harris, and the United States Strategic Air Forces under General Spaatz. Adm. Sir Bertram H. Ramsay took command of the naval forces for the invasion, with Rear Adm. (later Admiral of the Fleet) Sir Philip Vian commanding the Eastern Naval Task Force, scheduled to transport British troops, and Rear Adm. (later Adm.) Alan G. Kirk the Western Naval Task Force, which was to carry the American assault forces.

**Final Plans.**—After studying the Overlord concept, Generals Eisenhower and Montgomery concluded that the initial assault needed to be strengthened and yet made on a broadened front. This required additional landing craft, troops, and vehicles, and this in turn led to debate over whether the diversionary invasion on the Mediterranean coast of France, an operation code named Anvil, was really necessary. When the Anzio beachhead in Italy exerted its requirements for shipping, Eisenhower in March 1944 suggested canceling Anvil as an attack simultaneous with Overlord. In accepting the recommendation, the CCS assured SHAEF of the additional landing craft and other matériel needed for a stronger cross-Channel attack, but the complex requirements of assembling the means for the invasion of Europe had made it necessary to change the landing date from May to June. Meanwhile, on February 1, Montgomery, Ramsay, and Leigh-Mallory had drawn the initial joint plan (Neptune) for the invasion. A refinement of the Overlord concept, Neptune was at the same time a directive instructing the subordinate headquarters to plan the assault in greater detail.

As finally completed in the spring of 1944, the invasion plan called for assaults by the United States First and British Second armies. The First Army was to invade the Normandy shore in the Carentan-Isigny area with two corps. Northwest of Carentan the 82d and 101st Airborne divisions were to drop near Ste.-Mère-Eglise in order to assist the 4th Infantry Division of the 7th Corps to land on Utah Beach near Varreville. East of Isigny, in the 5th Corps zone, the 1st Infantry Division with part of the 29th Division was to land over Omaha Beach near Vierville-sur-Mer. Operating in the Bayeux-Caen area, the British were to send the 50th Division under the 30th Corps across Gold Beach near Arromanches-les-Bains, the Canadian 3d Division under the 1st Corps across Juno Beach near Courseulles, and the 3d Division, also under

the 1st Corps, across Sword Beach near Lion-sur-Mer. The 6th Airborne Division was to drop northeast of Caen near the mouth of the Orne River to protect the British flank.

The troops making the amphibious landings were to be carried by naval transports to positions 11 miles offshore in the American zone and 7 miles offshore in the British zone. The troops then were to board LCVP's (landing craft, vehicle and personnel) and LCA's (landing craft, assault), each craft carrying about 30 men. The small craft were to go in abreast in waves and touch down at regular intervals along the length of the assault beaches. Following them were to be larger craft carrying heavy weapons, guns, tanks, and engineer equipment. Finally, LST's (landing ships, tank) were to nose onto the beaches and disgorge additional men, equipment, and supplies. Naval fire-support plans emphasized neutralizing enemy positions rather than destroying them. The air forces planned to maintain an umbrella of fighter planes to protect the ground and naval units from German air attacks and also to provide air bombardment to help the ground forces overcome obstacles impeding their progress ashore.

Long before the day of invasion, called D-day, the air forces had begun to play a significant preparatory role. Since 1942, British and American airmen had bombed military targets in German-occupied Europe, but no clear directive or over-all plan had existed before the combined bomber offensive directed by the CCS at Casablanca in January 1943. The targets of this offensive were the German industrial and economic systems and the morale of the German people. The Americans favored daylight precision bombing to destroy critical sectors of German industry. Believing daylight bombing too costly, the British favored night bombardment aimed at destroying entire industrial and military areas. Each operated according to its own doctrine, both concentrating on submarine construction yards, airplane factories, transportation systems, oil plants, and other war industries. In October 1943, attempts were first made to coordinate the bombings from North African and Italian bases with the combined bomber offensive from the United Kingdom.

In April 1944, Eisenhower took control of the strategic air forces and used them in support of Overlord. Though the over-all mission of destroying the German military and economic system remained, the particular mission was to deplete the German Air Force and destroy the facilities serving it, to destroy the German oil industry, and to disrupt rail communications, especially those that might serve the Germans in moving reinforcements to the Overlord lodgment area. Heavy air attacks in May 1944 shifted to bridges over the Seine, Oise, and Meuse rivers, and by June Allied air attacks had weakened the railroad transportation system in France to the point of collapse.

**French Resistance.**—Contributing toward the disruption of the railroads and highways in France were the efforts of the French resistance, a movement that had sprung up spontaneously after the surrender of France in 1940. As early as that year a headquarters established by Gen. Charles de Gaulle in London formed a special staff which was charged with organizing, directing, and supplying resistance units. For more than two years this agency worked to amalga-



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**Top:** A group of French civilian guerrilla fighters, taken prisoner by the Germans, is lined up to be shot. **Bottom:** In August 1944, as Paris is liberated, German troops surrender to a detachment of Free French forces.

mate the autonomous resistance groups. The culmination of its efforts was the formation of a National Resistance Council, which met for the first time in Paris on May 27, 1943, under the presidency of Jean Moulin. Representing not only the main resistance groups but also the principal political parties, the council recognized de Gaulle and his London headquarters as trustees of the French nation, responsible for founding eventually a French government based on democratic principles. De Gaulle's personal representative, Moulin, became the political leader of the resistance, and the National Resistance Council created an underground army organized on a regional basis. In the following month the Gestapo smashed the organization by making wholesale arrests. Moulin died under torture, and the leadership was decimated. The result was the decentralization of the resistance and its concentration on sabotage and paramilitary action.

Beginning in November 1940, the Special Operations Executive (SOE), a British organization, encouraged, directed, and supplied the French resistance. Operating under the minister of economic warfare, the SOE eventually had the aim of developing the resistance into a strategic weapon that could be directed by Allied headquarters against military objectives in accordance with a master plan. The SOE therefore set up and maintained communications between London



and resistance centers in France, parachuted agents into the country beginning in the spring of 1941, and dropped such supplies as explosives, small arms, flashlights, and radios. In 1942 the SOE parachuted 17 radio operators and 36 other agents into France.

At the beginning of 1943, when the Germans put into effect a forced labor draft in France, thousands of young Frenchmen, particularly in central and southern France, rebelled. To escape the draft, they formed *maquis* bands to conduct guerrilla warfare against the Germans and the collaborationist French Militia. The SOE assisted by increasing the amounts of supplies dropped into France. The American Office of Strategic Services (OSS) began to take part in the underground movement at this time by sending its own agents into France in cooperation with the SOE. The London headquarters of the OSS was fused with the British agency in January 1944, when American planes also began to fly supply missions to the resistance.

In the fall of 1943, COSSAC took responsibility for directing those aspects of the partisan and underground movements on the Continent insofar as they related to invasion plans. SOE and OSS operations came under the control of COSSAC and eventually under General Eisenhower's headquarters, SHAEF. Because it was hard to assess resistance strength, because German arrests could suddenly emasculate the movement, and because control of resistance activities was difficult and uncertain, the Allied planners decided to regard resistance help as a bonus rather than trying to use it to gain strategic objectives. Consequently, the underground army in France, numbering about 200,000 men, confined itself to gathering and transmitting intelligence information and performing sabotage in war industries, against railroads and canals, and against telephone and telegraph facilities. Accelerating its sabotage in 1944 against German troops and supply trains, the resistance cut tracks, destroyed bridges, and damaged locomotives in a campaign closely attuned to the Allied air offensive.

In late May and early June, in order to regularize the resistance activities, General de Gaulle, with the blessing of the Allied leaders, established a headquarters and staff in London for the French Forces of the Interior (FFI), with Gen. Joseph P. Koenig in command. The FFI then became a component of the Allied armies under Eisenhower, the supreme Allied commander. To link the resistance groups in France more closely to the Allied command, so-called Jedburgh teams (consisting of a French and an American or a British officer, plus a radio operator) were parachuted into France in uniform shortly before D-day. About 87 teams were operational in France at one time or another. Though it is difficult to evaluate the effectiveness of the resistance, there is no doubt that it was a moral as well as a material force that contributed to the eventual defeat of the Germans.

**German Forces.**—On the German side, Adolf Hitler exercised direct control over military operations. He was the supreme commander in chief of the armed forces (Wehrmacht). His staff was the High Command of the Armed Forces (*Oberkommando der Wehrmacht* or OKW), headed by Field Marshal Wilhelm Keitel. Under OKW, in theory, were the Air Force High Command (*Oberkommando der Luftwaffe* or OKL), headed

by Reich Marshal Hermann Goering (Göring), the Navy High Command (*Oberkommando der Kriegsmarine* or OKM), under Grand Admiral Karl Doenitz (Dönitz); and the Army High Command (*Oberkommando des Heeres* or OKH), headed by Hitler. In actuality, OKH directed the Russian campaign, while OKW was responsible for western Europe.

Navy Group West and the Third Air Fleet controlled naval and air forces in western Europe. The ground force field command was the *Oberbefehlshaber West* (OB West), which acted somewhat like a theater headquarters under Field Marshal Gerd von Rundstedt, the commander in chief in the west, who operated under Hitler's close supervision. The operations staff of OKW, the *Wehrmachtführungsstab* (Wfst), under Col. Gen. Alfred Jodl, was the direct agent between OB West and Hitler. Rundstedt controlled two army groups: Army Group G under Col. Gen. Johannes Blaskowitz, responsible for the Mediterranean (Nineteenth Army) and Atlantic (First Army) coasts of France; and Army Group B under Field Marshal Erwin Rommel, charged with defending the Channel coast with the Seventh and Fifteenth armies.

The chain of command that operated at the time of the invasion was Hitler, who made his wishes known through the Wfst of OKW (Jodl), to OB West (Rundstedt), to Army Group B (Rommel), and then to the Seventh Army, which was responsible for defending the lodgment area designated by the Overlord plan as the objective of the invasion force.

The steady drain of the eastern front left the Germans in France with two kinds of units, old divisions that had lost many good men and much equipment, and new divisions that were either of excellent combat value or were only partially equipped and trained. In June 1944, Rundstedt had 58 combat divisions, of which 33 were static or reserve divisions classified for limited defensive employment, 24 were well trained and equipped, and 1 was still being equipped. All the infantry divisions were committed on or directly behind the coast under one of the four armies or the armed forces commander in the Netherlands. The Seventh Army controlled Brittany and most of Normandy; the Fifteenth Army, the Pas-de-Calais.

The command in western Europe had its peculiarities. Rundstedt, for example, had no command over the Third Air Fleet, which was directly subordinate to OKL. The aircraft in France were too few in number for decisive effect; of the 400 fighter planes based in France, only half were operational because of shortages of spare parts, fuel, and trained pilots. Nor did Rundstedt control Navy Group West, under OKM, even though the destroyers, torpedo boats, and smaller naval vessels were based in ports within his jurisdiction. The air force had administrative control over parachute troops and antiaircraft artillery units; the navy controlled most of the coastal artillery. In addition, two military governors, one in France and the other in northern France and Belgium, were under OKH, though their security troops could be appropriated by Rundstedt to repel an invasion. Rommel, the Army Group B commander, was under Rundstedt, but Rommel's dominant personality and his prerogative of direct communication with Hitler, a prerogative enjoyed by all field marshals, gave him an influence greater

than that due his formal command authority.

Hundstedt favored maintaining a mobile reserve to be rushed to the invasion area when the main landings were recognized. Rommel, believing that Allied air superiority would prevent the movement of a mobile reserve to the landing beaches to repel the invaders, depended exclusively on fortifications near the water's edge. Thus Rommel directed much of his efforts to building coastal defenses. He favored a large number of simple, field-type defenses over a few complicated and massive fortifications. He emphasized the use of mines, underwater obstacles, stakes, Belgian gates, tetrahedra, and hedgehogs in the hope of entangling the Allied troops as they landed and making them vulnerable to those who waited at the shore to repel them. Rommel's construction and minelaying required considerable labor. Because Organization Todt, the construction agency of the German Army, was employed chiefly in major port fortress areas and on railroad maintenance, the troops themselves worked on the Atlantic Wall in 1944, in many cases to the detriment of their training programs.

By the time of the invasion a new weapon was ready to be put into operation. This was the air missile called the V-1, for *Vergeltungswaffe* (vengeance weapon). From the Pas-de-Calais area the Germans would begin on June 13 to launch these flying bombs against England and its civilian population as a reprisal for Allied air attacks on German cities. In September, the V-2, a deadlier supersonic rocket, would be introduced.

**Deception Plan.**—One of the vital elements of the invasion was the erroneous German expectation of landings in the Pas-de-Calais. Believing that a number of Allied divisions in the United Kingdom belonged to "Army Group Patton," the Germans concentrated a strong Fifteenth Army in the Pas-de-Calais, the coastline nearest to England and the area in western Europe

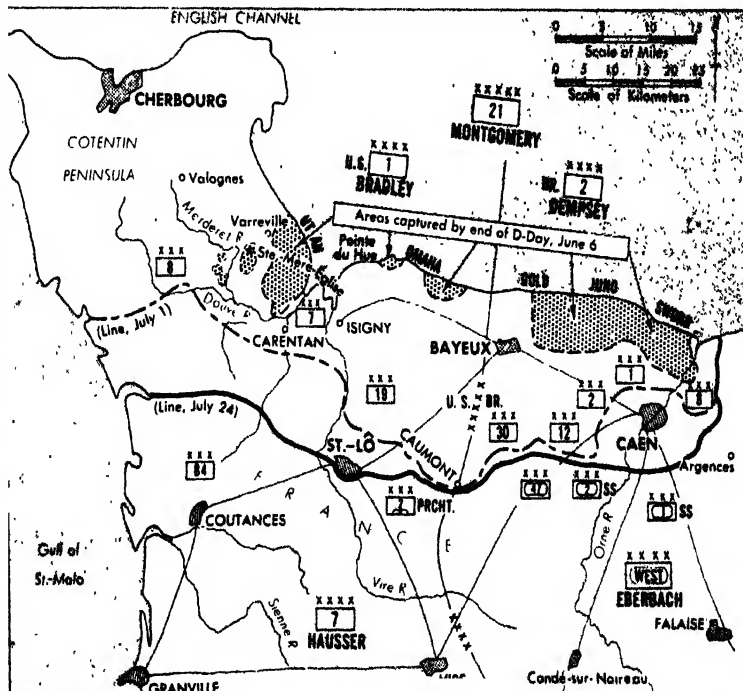
closest to the classic invasion routes into Germany. The Allies nourished this belief by a gigantic deception plan designed to convince the Germans that Overlord was only part of a larger invasion effort. Naval demonstrations off the Channel coast, false messages, dummy installations, and other signs of impending coastal assault kept the Germans in a continual state of alert and alarm and immobilized the considerable force of the Fifteenth Army.

The Allied hoax continued well beyond the Overlord invasion. Early in July, the designation of the United States First Army Group was changed to the Twelfth in order to retain in England a fictitious headquarters that the Germans might think capable of launching another invasion. Lt. Gen. Lesley J. McNair, commander of the Army Ground Forces, who was visiting the European theater, was placed in command of the fictitious army group. Later, when McNair was killed while observing the battle in Normandy, Lt. Gen. John L. De Witt was rushed to England in order to give continuing verisimilitude to the Allied deception measures. When the Third Army was committed on the Continent, Patton's name was at first kept secret for the same reason. Eminently successful, the deception maneuvers fooled the Germans for nearly five months. During the invasion and the subsequent battle for Normandy, when the Germans could well have used reinforcements from the Pas-de-Calais area, the Fifteenth Army remained untouched and immobile, awaiting an invasion that never came.

#### INVASION AND CAMPAIGN FOR NORMANDY

**Invasion.**—On May 8, General Eisenhower designated D-day as June 5, but because of bad weather he decided on June 4 to postpone the invasion to June 6. Though the weather remained poor, further delay would have necessitated waiting until June 19, when tidal conditions and

**Map 9. ESTABLISHMENT OF THE NORMANDY BEACH-HEAD (June 6-July 24, 1944).** German opposition to the landings was strong at all beaches except Utah Beach, and it was particularly fierce at Omaha. Nevertheless, by nightfall of the first day the Allies held footholds on the shore as shown. During the succeeding days no serious counterattacks developed, for the Germans had been deceived into believing that the main landings were still to come farther north, in the Pas-de-Calais area, and were husbanding their forces to counter them. By July 1, the Allies had landed almost 1,000,000 men and had cleared most of the Cotentin Peninsula. By July 24, the line had been advanced as shown, and the American forces stood poised to strike southward at St.-Lô.



Early in the morning of D-day, June 6, 1944, men of the United States 1st Division, pinned down by German fire off Omaha Beach in Normandy, take shelter behind underwater obstacles of the coast defenses.

Robert Capa-Magnum

the light of the moon would again have been propitious. In one of the most momentous decisions of the war he decided to proceed despite the unfavorable weather conditions. Meanwhile, the invasion troops had moved to concentration areas in the United Kingdom. There they received special equipment and waterproofed their vehicles. Then they marched to marshaling areas close to the embarkation points, where the troops received additional supplies, maps, and final briefings. About 60,000 men and 6,800 vehicles were scheduled to go ashore on D-day at Omaha Beach and equal numbers at Utah. On D plus 1 and 2, an additional total of 43,500 troops and 6,000 vehicles were scheduled to go ashore at both beaches. Roughly equal numbers were to land on the British beaches. Altogether in the United Kingdom, General Eisenhower had a force of 2,876,000 men, including 45 divisions.

Some 5,000 ships and craft made up the invasion fleet. During the night of June 5, despite a gusty wind blowing at a rate of 15 to 20 knots and churning up waves in mid-Channel as high as five and six feet, the invasion fleet took assigned places in the transport areas off the coast of France in the Seine Estuary. Minesweepers cleared and marked 10 lanes through minefields in the Channel. In the early minutes of June 6, RAF bombers ranged the entire invasion coast, striking at coastal batteries and other targets. In the second hour, paratroopers of the 82d and 101st Airborne divisions landed in the eastern part of the Cotentin Peninsula astride the Merderet River to facilitate the seaborne landings of the 7th Corps. The 101st Division secured its objectives with surprisingly light losses, but the 82d had to fight severely, taking heavy casualties, to secure Ste.-Mère-Eglise. At the same time the British 6th Airborne Division was securing the other Allied flank between the Orne and Dives rivers. As dawn approached, while fighter squadrons flying at from 3,000 to 5,000 feet maintained an aerial umbrella, the landing craft came toward shore through a heavy sea.

Because lack of planes in France denied adequate aerial reconnaissance, the Germans had no advance knowledge of the invasion. They also relied on the bad weather, considering it too inclement for the Allies to try an invasion at that time. Their first reaction occurred early in the morning of June 6, when several German torpedo boats left Le Havre to engage the invasion fleet. They were driven off by Allied naval fire and air attack. The German coastal batteries began to fire sporadically at the invasion fleet at 5:35 A.M. At 5:50 A.M., the Allied naval bombardment began. This fire not only detonated large mine fields, on which the Germans had counted heavily to block the invaders, but also knocked out many defensive installations.

At 6:30 A.M., H-hour for the United States beaches, American troops touched down on Omaha and Utah beaches. At Utah the 4th Division and the 7th Corps had little difficulty getting ashore against intermittent artillery shelling. The beach area was cleared in three hours, and the



follow-up troops and supplies began to come ashore with little trouble. About 23,000 men landed that day. At Omaha, where the 1st Division of the 5th Corps assaulted with two regiments abreast, high seas, early morning mist, smoke, dust, and a lateral current scattered men and units badly. German fire was exceptionally strong, and many wounded Americans were drowned in the rising tide. In a daring operation two Ranger battalions took out large coastal guns at Pointe du Hoc after scaling cliffs with rope ladders, but after the first three hours of the invasion it appeared for a while that the Omaha invaders had been stopped on the beach. The presence of an elite German infantry division that for three months had escaped Allied intelligence accounted in large measure for the difficulties of the 5th Corps. Only through improvisation and courageous personal leadership were the troops at last able to get off the beach and onto the cliffs beyond. Even then the infantry had very few heavy weapons and no supporting artillery. The beach was congested with disabled and burning vehicles, and the beachhead was a strip of land less than 2 miles deep. Nevertheless, as night fell, 34,000 men were ashore.

Troops of the British Second Army meanwhile began to land at 7:20 A.M. On Gold Beach the advance elements of the 50th Division were pinned down at first by German fire, but gradually they worked their way around the resistance and pushed rapidly inland. By the end of the day they had advanced about 5 miles. The Canadian 3d Division on Juno Beach met even stiffer resistance, but once clear of the beaches the Canadians moved rapidly and by the end of the day had reached the Caen-Bayeux highway. The British 3d Division on the left also met intense opposition on Sword Beach, but by the end of the day linked up with the 6th Airborne Division.

Despite the immense problems at Omaha Beach, the Allies by the end of D-day had established apparently solid footholds on the Continent. Casualties everywhere, including bloody Omaha, were lighter than expected. They were lightest of all at Utah Beach (less than 200), though the airborne divisions behind the beach lost 2,499 men, including 338 known dead and 1,257 missing. At Omaha the Americans lost approximately 2,000 men. British and Canadian casualties were about 4,000.



Though German opposition had been firm on all beaches except Utah and particularly disturbing at Omaha, D-day passed with a surprising lack of counterattacks. Only near Caen, where a panzer division in late afternoon struck the British 3d Division, was there more than passive resistance, and the 3d Division stopped this thrust with little loss of ground. The most significant German development was the ordering of a panzer corps to the Caen area, a harbinger of the fact that the Germans saw the British landings and their threat to open ground leading toward Paris as the Allied main effort.

By the end of D-day, the Americans had landed the equivalent of 8 regiments amphibiously. By the end of the following day, 5 divisions (including the 2 airborne divisions) were ashore and operational, though all were deficient in transportation facilities, tank support, artillery, and supplies. An ammunition shortage was serious, particularly on Omaha. The Americans had planned to have about 107,000 troops ashore by the end of the second day, but the total was approximately 20,000 short. Only about half the planned 14,000 vehicles had been disembarked, and only a fourth of the anticipated 14,500 tons of supplies were on the beaches.

Meanwhile, Eisenhower ordered Bradley's First Army to give priority to the task of linking the two American beachheads and of making contact with the British. In compliance with this order the 1st Division pushed eastward to gain contact with the British on June 8, the 29th Division took Isigny on June 9, and the 101st Airborne Division captured Carentan on June 12. With Carentan in hand and the beachheads joined, the 7th Corps turned its attention to Cherbourg. Halting further expansion inland of Maj. Gen. (later Gen.) Leonard T. Gerow's 5th Corps, which had taken Caumont and was near the road center and departmental capital of St.-Lô, Bradley on June 13 placed the bulk of the incoming resources at the disposal of Maj. Gen. (later Gen.) J. Lawton Collins' 7th Corps. During the night of June 17, the 7th Corps cut the Cotentin Peninsula and sealed off Cherbourg from German reinforcement. Two days later, Collins began to push northward toward the port city with 3 divisions. Organized resistance in Cherbourg ceased on June 27. Meanwhile, headquarters of the 19th Corps, commanded by Maj. Gen. Charles H. Corlett, had entered the line near St.-Lô on June 14. Maj. Gen. (later Lt.

Gen.) Troy H. Middleton's 8th Corps also arrived and took control of the forces at the base of the Cotentin Peninsula on June 15. The British had meanwhile captured Bayeux and expanded and enlarged their beachhead, but Caen, a D-day objective, remained out of reach.

In these early days the Allies used two methods to get supplies ashore: direct discharge onto the beach from landing craft and unloading the cargo carried by larger vessels moored offshore into ferry craft and DUKW's (amphibious trucks) for transport either to the beach or to the artificial ports (Mulberries). Not until the destroyed facilities at Cherbourg were repaired in mid-July was this port to begin to take some of the logistical strain from the beaches. A great storm that raged between June 19 and June 22 wrecked scores of craft and smashed the artificial harbors. High winds demolished the American Mulberry beyond repair, but the British artificial quay was later restored to full use. Nearly 100 LCVP's and LCM's, plus many LCT's and larger craft, were lost and 19 of 20 rhino ferries were destroyed. Despite this calamity, which stopped unloading operations for several days, the Allies developed an ability to bring ashore over the open beaches surprisingly large amounts of tonnage.

By July 1, three weeks after the initial landings, the first phase of the invasion came to an end. Almost 1,000,000 men, more than 500,000 tons of supplies, and 177,000 vehicles had been landed in the American and British zones. A total of 27 Allied divisions had arrived on the Continent, and more were about to come. The German's golden opportunity to smash the invasion by decisive counterattack before the Allies were firmly established had passed. German failure to react in strength was attributable to the condition of the French railroads and to unrelenting air attacks that enabled German divisions to reach the battle zone only with utmost difficulty and after serious delays. Units arrived piecemeal, often lacking essential weapons and short of fuel and ammunition. Continuing pressure of Allied attacks then forced German commanders to commit the new divisions as they arrived so that a major counterattacking force could never be assembled. The two leading German commanders on the scene, Rundstedt and Rommel, both were convinced that they now had no chance to drive the Allies into the sea. Persuaded that Germany had lost the war,

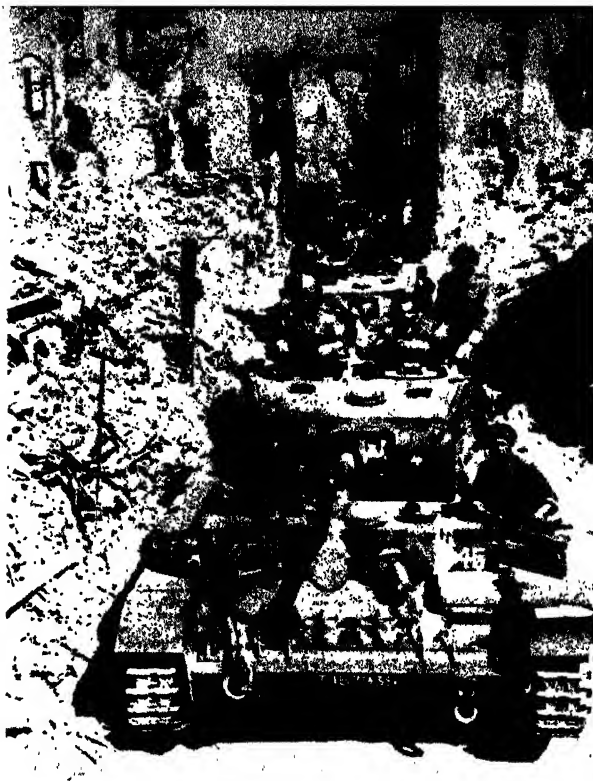




**Breakthrough.**—To penetrate the German defenses and make a limited exploitation to the town of Coutances, General Bradley on July 13 drew an outline plan called Cobra. This plan projected a heavy attack on a narrow front just west of St.-Lô, the ground effort to be propelled forward by a mighty air attack. Bradley concentrated 6 divisions under Collins' 7th Corps and called for support by heavy bombers. Some planes in Operation Cobra were already under way when overcast skies forced a day's postponement. Failing to receive word of the delay, approximately 350 bombers already over the target dropped around 700 tons of bombs, some of which struck American troops. On July 25, the operation officially got under way as 2,500 planes dropped approximately 4,000 tons of bombs on a rectangular "carpet" 7 miles long and 2 miles wide along the Périers-St.-Lô highway. Though some bombs again fell short and caused casualties among the American ground troops, 3 infantry divisions followed the bombardment closely and attempted to open a hole for exploiting forces. The Germans, though badly hurt, appeared to be holding, but commitment of 2 additional American divisions on the second day and a third on the next opened a tremendous breach. General Bradley had achieved his breakthrough. Modifying his plans, he broadened the scope of the operation, and all four corps of his First Army drove ahead. By the end of the month the 7th and 8th Corps in less than a week had advanced about 30 miles. Far beyond Coutances, Americans took Avranches and gained the base of the Cotentin. This made possible not only a swing to the west into Brittany but a swing to the east, around the German left flank, toward the Seine River and Paris.

The outstanding achievement of the last week in July was the result of many factors. The Americans had outmaneuvered the Germans. Hard fighting by the 19th Corps at Tessy-sur-Vire had blocked Kluge from sending two panzer divisions into the Cobra area to disrupt the breakthrough operation. Aggressive armored action, supported by tactical aircraft giving excellent close support, trapped considerable German forces near Coutances. Bradley's forces had, in effect, crushed the German left flank and thereby invalidated Hitler's tactic of standing fast until new developments in weapons might alter the situation. On August 1, Bradley turned over the command of the First Army to Lt. Gen. (later Gen.) Courtney H. Hodges. On the same day, General Patton's Third Army became operational. Both armies went under the command of Bradley, who became the commander of the Twelfth Army Group.

**Breakout into Brittany.**—Middleton's 8th Corps, now under the Third Army, turned west from Avranches and entered Brittany. One armored division drove to Rennes and then to Lorient, another armored division drove to Brest, and an infantry division moved to St.-Malo. The entrance of American troops into Brittany chased the Germans into these port cities, as well as St.-Nazaire and Nantes, which Hitler had designated as fortresses to be held to the last man. While small American forces contained the Germans in the port cities, siege operations got under way at St.-Malo, which was finally captured on August 17. The 8th Corps then moved to Brest and initiated siege operations on August 25. A fierce battle at that city finally ended on Sep-



Wide World

Armored units of the Canadian First Army advance toward Falaise in August 1944 to form the northern arm of an Allied trap for the German Seventh Army.

tember 18. Meanwhile, headquarters of the United States Ninth Army, under Lt. Gen. William H. Simpson, had been committed in Brittany in order to provide control over operations that were increasingly farther behind the main front.

Though operations in Brittany had been undertaken with the object of gaining the port cities as points of entry for additional troops and supplies coming directly from the United States, the strong German defenses at St.-Malo and Brest

Troops of the United States 8th Corps enter La Haye-du-Puits in western Normandy. The town, first entered on July 5, was finally secured two days later.

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and the accompanying destruction of the port facilities prompted a change in Allied plans. Not only did the Allies decide not to rehabilitate the destroyed port cities; they also decided not to commence constructing the port complex at Quiberon Bay, the project code named Chastity, for by this time Brittany was far removed from the main stage of operations. Early in August, the main Allied armies had swept eastward from Avranches.

**Breakout to the East.**—When the Third Army became operational on August 1, General Patton took control not only of the 8th Corps operations in Brittany but also of Maj. Gen. (later Gen.) Wade H. Haislip's 15th Corps, which turned southeastward toward Mayenne. Taking Mayenne on August 4, capturing Laval on August 5, and seizing Le Mans on August 8, the 15th Corps formed an enveloping pincer that extended more than 75 miles around the German left flank. Meanwhile, the First Army also swung southeastward toward the road centers of Vire and Mortain, thereby starting a swinging movement designed to carry the Allies to the Seine River and the periphery of the lodgment area envisioned by the Overlord planners. But the Germans turned and sprang. Hoping to regain Avranches and thereby to close the hole that Bradley had punched in their defenses, the Germans launched a counterattack at Mortain on August 7. They were motivated by the desire to reestablish the conditions of static warfare that had served them well during June and most of July. They struck the 30th Infantry Division of Collins' 7th Corps with full force. Quickly reinforced by Bradley, the 7th Corps fought a magnificent defensive battle to halt the German threat.

By attacking westward through Mortain toward Avranches, the Germans had placed their heads into a potential noose. Bradley saw the possibility of encircling the Germans and proposed this maneuver to Montgomery, who agreed. Bradley therefore directed Patton to turn the 15th Corps northward from Le Mans toward the successive objectives of Alençon and Argentan with the purpose of cutting behind the Germans at Mortain. If Montgomery's forces drove southward from the Caen area and reached Falaise, the Allies would form a pocket and threaten the enemy's Fifth Panzer and Seventh armies with encirclement and annihilation. General Crerar's Canadian First Army, which had become operational on the Continent on July 23, attacked southward toward Falaise on August 8, but gained little ground. In contrast, Haislip's 15th Corps took Alençon and was within sight of Argentan by August 13. Because the American troops had reached the boundary line separating American and British zones of operations, Bradley ordered Patton to halt further advance by Haislip's corps. This decision was dictated in part by the fact that Crerar was about to launch a heavy attack on the following day. On August 14, after 800 planes had dropped 3,700 tons of bombs to clear a path for the ground troops, the Canadians launched their attack. Two days later they reached Falaise. Allied forces were then only 15 miles apart, but the Germans were escaping eastward out of the pocket through this 15-mile sector, called the Argentan-Falaise gap.

Bradley had meanwhile approved Patton's plan to send part of the 15th Corps to the Seine.

This movement got under way on August 14. Five days later the 79th Division was crossing the Seine River and establishing a bridgehead on the east bank. Other troops of the 15th Corps, soon joined by the First Army's 19th Corps under Corlett, were driving down the west bank of the Seine and pushing the Germans toward the mouth of the river, where escape crossings were harder to find. While this second encirclement at the Seine was in progress, the Allied troops holding the shoulders of the first encirclement at Argentan and Falaise were at last making contact at Chambois and Trun. They thus closed the pocket on August 20, trapping more than 50,000 German troops, destroying an additional 10,000, and sending the Fifth Panzer and Seventh armies reeling eastward across the Seine in defeat. Field Marshal Walter Model meanwhile had become commander in chief in the west, replacing Kluge, who committed suicide.

By this time two more American corps had come on the scene. Maj. Gen. (later Gen.) Walton H. Walker's 20th Corps, after taking Angers, turned to take Chartres. Maj. Gen. Gilbert R. Cook's 12th Corps drove toward Orléans. By August 20, when the First and Third armies pulled up to the Seine, Eisenhower had already decided to ignore the original limits of the lodgment area and cross the river in strength in pursuit of the disorganized enemy force. Meanwhile, as British and Canadian armies moved to the Seine, American and French troops liberated Paris.

**Liberation of Paris.**—The climactic incident in the Normandy campaign was the liberation of Paris, which occurred almost by accident. In order to avoid a battle that would damage the French capital and inflict casualties on its inhabitants, General Eisenhower intended originally to bypass Paris. Hitler for his part wished to retain the city for the prestige involved, and he designated it a "fortress" to be fought over until it was, as he put it, "a field of ruins." The French wanted Paris liberated not only because its capture would signify a crowning achievement for the resistance, but also because it would establish General de Gaulle in the seat of government. Thus a three-cornered struggle developed, with the Germans preparing to fight on the western outskirts and, if necessary, inside the city, with the French putting pressure on Eisenhower to send troops to liberate the capital, and with the Allies preparing to go around the city in the more important pursuit to the German border and in the hope that the capital would fall into Allied hands once it was isolated. A spontaneous uprising within the city on August 19 changed all plans.

Lacking the means to put down the uprising in the face of Allied advances near the city and unwilling to destroy the capital, the German commander concluded a truce with the resistance leaders. Erroneous reports that the Germans were about to destroy the city before withdrawing, as well as news of grave food shortages in Paris, prompted Eisenhower to change his mind. When he directed Bradley to take the city, Bradley sent a Franco-American force under Gerow's 5th Corps to perform the act. Gen. Jacques Philippe Leclerc's 2d Armored Division was given the honor of the first entry into the city. But the German defenses on the outskirts of Paris proved stronger than had been anticipated. Though a small French unit penetrated into the

enter of the city around midnight of August 24, the actual liberation had to await the next day, when both French and American troops entered Paris. The German defense quickly collapsed, and the German commander surrendered.

#### INVASION IN THE SOUTH AND DRIVE TO THE EAST

**Invasion of Southern France.**—Even as Allied troops swept victoriously across Normandy, another Allied force staged a second amphibious invasion on August 15, this time on the south coast of France between Cannes and Toulon. This was the long-postponed Operation Anvil (also known as Operation Dragoon). Though Eisenhower in the spring of 1944 had recommended that this invasion not be launched at the same time as the landings in Normandy, he wished only to gain additional landing craft for his major invasion, and neither the Allied commander nor other American officials endorsed abandoning the operation altogether. Against British resistance, notably from Churchill, who continued to favor expanded operations in other parts of the Mediterranean, Eisenhower had continued to believe an invasion of southern France essential to the success of Overlord.

Allied entry into Rome two days before the Normandy invasion at last made it clear beyond doubt that some resources could be spared from the Mediterranean to assist Overlord. After considering various operations, including an invasion of the southwest coast of France, Allied planners finally decided to strike the south coast on August 15, though all British objections did not end until shortly before the target date. The invasion was designed to prevent German forces in the south from moving against Overlord and to provide the Allies with a supplementary line of supply through the Mediterranean ports, particularly Marseille.

Behind a heavy air and naval bombardment three United States divisions (the 3d, 36th, and 45th) under the 6th Corps, commanded by Maj. Gen. (later Lt. Gen.) Lucian K. Truscott, and an attached French armored force began landing early on the morning of August 15 on either side of St.-Tropez. Meanwhile, a task force composed of American and British paratroopers landed behind the invasion beaches to cut roads and isolate the German defenders. The over-all commander was Maj. Gen. (later Lt. Gen.) Alexander M. Patch, commander of the United States Seventh Army. The German force responsible for defending southern France, Army Group G under General Blaskowitz, had only 11 divisions for the task. Though the German High Command had been considering the withdrawal of Army Group G to the north, no action had been taken when the invasion came. Their forces spread thin, the Germans could muster only spotty resistance on the beaches. Two days later, OKW ordered Blaskowitz to leave forces to hold the major ports and pull back toward the Vosges Mountains in northeastern France.

The success of the Allied invasion was spectacular. On the first day alone, 86,000 men, 12,000 vehicles, and 46,000 tons of supplies were put ashore. In only a few days the United States divisions were fanning out from the beaches and heading north up the Route Napoléon toward Grenoble. Under Gen. Jean de Latre de Tassigny, a follow-up French force (later designated the French First Army) swung westward against Toulon and Marseille, where stubborn resistance

ended on August 28. On the same day troops of the 6th Corps seized Montélimar, 75 miles up the valley of the Rhone River, but were too late to trap German columns withdrawing from southwestern France. In two weeks the Allies nevertheless had opened two major ports and had taken 57,000 prisoners at a cost of only 4,000 French and 2,700 American casualties. American and French columns soon were matching the sweeping advances in northern France. French resistance forces swarming from the mountains aided the drive materially. As Lyon fell on September 3, the Allied forces turned northeastward toward the Belfort gap. On September 11, patrols from the southern force met patrols of Eisenhower's northern force near Dijon. Four days later, the troops in the south, organized now as the Sixth Army Group under the command of General Devers and composed of the United States Seventh and French First armies, came under General Eisenhower's command.

The invasion of southern France and the subsequent drive north succeeded beyond all expectations. The Germans lost 80,000 men in prisoners alone, while Allied casualties totaled 7,200, about equally divided between Americans and French. On the other hand, the Germans by their timely withdrawal managed to extricate more than half of Army Group G from entrapment. Having reached the foothills of the Vosges, the Germans turned to fight back. Though the Allies continued their attacks, a shortened German defensive line and overstrained Allied supply resources brought the sweeping gains to an end.

**Pursuit Toward the German Frontier.**—In the meantime, the main Allied armies in the north, having captured Paris and jumped the Seine on August 25, continued to pursue the Germans across northern France and Belgium toward the German border. In preinvasion planning, General Eisenhower had decided to advance against Germany on a broad front. He planned to make his main effort in the north through Belgium, passing Montgomery's Twenty-first Army Group to the north of the barrier of the forested Ardennes region of Belgium and Luxembourg along the most direct route to the Ruhr industrial area, the vast collection of coal mines and factories which was the main source of German industrial strength. Bradley's Twelfth Army Group was to advance south of the Ardennes through a lesser industrial area, the Saar. Yet as the extent of the German defeat became apparent, Eisenhower yielded to persistent demands from Montgomery to strengthen the forces in the north. Leaving Patton's Third Army to advance alone south of the Ardennes, he ordered Bradley to send Hodges' First Army north of the barrier alongside the British flank. This, Eisenhower reasoned, would speed Montgomery's capture of ports along the Channel, including the great port of Antwerp (Antwerpen). Another big port was essential to continued advance into Germany, for Brest, Cherbourg, and even Le Havre soon would be far behind the front. As General Crerar's Canadian First Army invested the minor Channel ports, Montgomery's troops dashed into Brussels (Bruxelles) on September 3 and the next day seized Antwerp. In the process, British and Canadians overran the V-1 launching sites which had been bombarding Britain since June. Though Antwerp fell with wharves and docks intact, the big port could not be used until the Germans were cleared from the banks of the Scheldt (Escaut, Schelde) Estuary, leading

60 miles to the sea. The British failed to turn a force immediately to this task.

The United States First Army meanwhile took Mons, Belgium, on September 3, trapping there 25,000 Germans who were trying to flee from the Channel coast, and then turned eastward toward Germany. Two days later, one corps was across the Meuse River. Liège fell on September 7, and the capital city of Luxembourg on September 10. As in France, resistance fighters materialized at many points, here preventing the retreating Germans from blowing a bridge, there dismantling a roadblock before the tank-led American columns arrived. On September 11, patrols of Gerow's 5th Corps crossed onto German soil. Patton's Third Army meanwhile captured Reims and Châlons on August 29, took Verdun, St.-Mihiel, and Commercy on August 31, and on September 7 established a bridgehead over the Moselle (Mosel) River south of Metz.

**German Reorganization and Allied Supply Problems.**—As patrols of the First Army crossed the German frontier and the troops from the invasion of southern France linked with those of Overlord, an early end to the war appeared not only possible but probable. The ragged columns falling back to the German border seemed thoroughly beaten, and on the eastern front Soviet armies, having driven the Germans from Russian soil, had begun to press into Poland. In the three months since the Allies had landed in Normandy, the Germans on all fronts had incurred more than 1,210,000 casualties. Day and night, British and American heavy bombers hammered German cities, factories, and rail lines. To many it seemed incredible that the divisions in the west, reduced to no more than half the strength of the 49 divisions which General Eisenhower had arrayed against them, could be rebuilt fast enough to forestall total defeat. Even most German commanders saw the only hope to be quick withdrawal behind the historic moat of the Rhine River.

On the other hand, Hitler from his position as over-all commander recognized that his Third Reich still possessed considerable power. He still had, for example, more than 10 million men in uniform. Despite Allied bombings, German factories still had been able to maintain a high rate of production and had yet to reach their wartime peak. Recognizing early in the summer that Germany could not hope to match the numbers of Allied tanks, Hitler had concentrated instead on producing heavier tanks that he considered tactically superior. These he ordered to be used to equip panzer brigades that might halt or delay the Allied armies until the shattered panzer divisions could be refitted and reorganized. By reducing the numbers of service troops, by converting sailors and airmen into infantrymen, and by at once lowering and extending the ages for induction into the armed forces, he ordered the early formation of 25 new divisions, all to support the western front. He also ordered into the line along the frontier 100 so-called fortress infantry battalions, heretofore used only in rear areas. Though Hitler could not hope to produce enough new airplanes to redress the tremendous imbalance in the air, he continued to put his faith in the early appearance of new jet-propelled planes. He also put considerable faith in a series of fortifications along the western border known as the West Wall. Called by the Allies the Siegfried Line, the fortifications had been constructed before the war from Switzerland to the point

where the Rhine enters the Netherlands. As much as 3 miles deep, the line consisted of hundreds of concrete pillboxes, observation posts, command posts, and troop shelters. Either such natural antitank obstacles as streams or concrete projections called dragon's teeth fronted the entire length.

Looking for a new commander who might rebuild the morale of the German soldier in the west, Hitler on September 5 recalled Field Marshal von Rundstedt as commander in chief. While Field Marshal Model remained as commander of Army Group B, Hitler charged Rundstedt with holding firm along the Dutch-Belgian border, in the West Wall, and along the Moselle River. As many as possible of the panzer divisions were to be regrouped quickly to counterattack into the south flank of the United States Third Army to cut off Patton's armored columns. The strength of the West Wall, when supplemented by the counterattack and the other emergency steps, would be sufficient, Hitler believed, to hold the Allies along the border until he could form a larger reserve force to strike back in a big counteroffensive. By means of the counteroffensive, he intended to force the Allies to settle for a negotiated peace, whereupon he might give his full attention to the Soviet Union.

A strong factor in Hitler's confidence was his belief that the Allies had outrun their supply lines. In this he was correct, though General Eisenhower and his subordinates hoped to get past the West Wall and establish bridgeheads over the Rhine before a pause became imperative. Eisenhower's problem was not a shortage of supplies on the Continent but a task of getting them to the forward troops, who in some cases were more than 500 miles from supply depots. The problem grew out of the explosive nature of the advance through France and the decision to forego a pause at the Seine, which had denied the supply services time to build an orderly logistical structure. Despite such extraordinary measures as the establishment of a one-way truck route called the Red Ball Express, the supply troops simply could not keep pace. For five days at the end of August, Patton's Third Army came to a complete halt at the Meuse for lack of gasoline. General Hodges of the First Army had to halt one corps for the same reason, and one British corps had to stop for more than a week to enable its trucks to supply the rest of the Second Army. Some idea of the immensity of the supply requirements is apparent from the fact that each division required 600 to 700 tons of supplies per day and that artillery and mortars expended ammunition at the rate of 8,000,000 rounds per month, almost as much as the entire American Expeditionary Force expended (10,000,000 rounds) in World War I.

**Operations in the Netherlands and on the Franco-German Border.**—In the light of the supply problems, Eisenhower's continued determination to proceed into Germany on a broad front seemed to two of his subordinates a mistake. Montgomery insisted vehemently that Eisenhower should concentrate all his resources behind one part of the front, preferably in the north, and make one sustained drive all the way to Berlin. General Patton resisted the idea just as strongly and insisted instead that, if given proper support, his Third Army could gain the Rhine in a matter of days. Though Eisenhower rejected both arguments, he nevertheless sanctioned a plan put forward by Montgomery to use 3 airborne divisions

to help the British Second Army across three major water obstacles in the Netherlands: the Maas (Meuse), Waal, and Lower Rhine (Neder Rijn) rivers. This accomplished, Montgomery might outflank the West Wall and gain a position from which he might drive into the North German plain to encircle the Ruhr from the north. In the meantime, the Sixth Army Group, using separate supply routes, was to continue through the Vosges to the upper Rhine, the Third Army was to drive into the Saar, and Hodges' First Army was to penetrate the West Wall at Aachen and gain a bridgehead over the Rhine near Cologne (Köln).

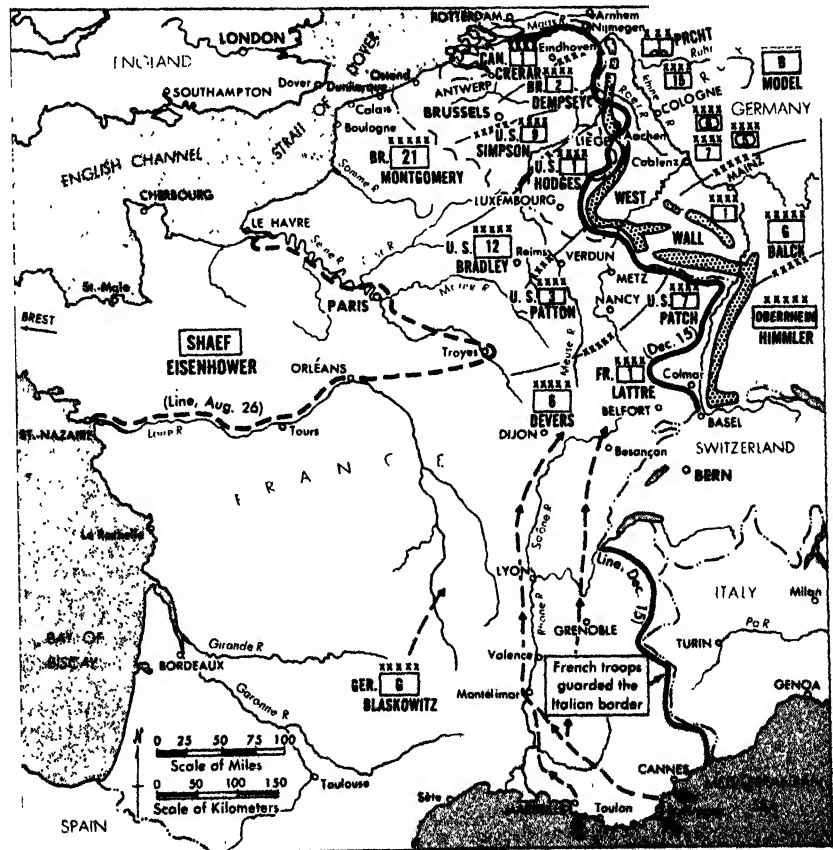
When Montgomery first proposed the airborne-assisted drive through the Netherlands, the Germans had almost no forces in a position to block it. Before the operation could be launched, however, Hitler rushed forward headquarters of the First Parachute Army under Col. Gen. Kurt Student to gather the fleeing troops and build a line along the Dutch canals. He also ordered into position several divisions from a 60,000-man force of the Fifteenth Army, which had escaped entrapment on the Channel coast by ferrying across the Scheldt Estuary after the fall of Antwerp.

The big airborne attack, labeled Operation Market, began on September 17. Under Lt. Gen. Lewis H. Brereton's First Allied Airborne Army, 3 divisions—the British 1st and the United States 82d and 101st—landed near Arnhem, Nijmegen, and Eindhoven in the largest airborne operation of the war. The airborne troops were to seize a narrow corridor 65 miles deep to enable the Second Army, in a companion ground attack called Operation Garden, to pass through and reach the

IJsselmeer (Zuider Zee), thereby cutting off all German forces in the western Netherlands. Though the airborne drops were uniformly successful and achieved full surprise, the British ground column ran into stubborn resistance and blown bridges that created serious delays. Before the ground forces could break through to the British airborne division at Arnhem, the farthest unit from the original front line, the Germans threw in remnants of 2 panzer divisions that had been reorganizing nearby. As the Germans pinned the British airborne troops to a narrow bridgehead north of the Lower Rhine, Montgomery ordered the commitment of a Polish airborne brigade, but to no avail. On September 25–26, the battered survivors (2,000 men out of an original force of not quite 9,000) withdrew to the south bank of the river.

The outcome of Market-Garden in itself would have been enough to demonstrate that the big pursuit was over, but, in addition, all Allied armies had run into trouble. Facing the German Nineteenth Army, which was strengthened by the forested foothills of the Vosges, the Sixth Army Group could make only limited gains. Though the Hitler-ordered counterattack against Patton's south flank was doomed from the start by inadequate strength and hasty mounting, sizable advances by the Third Army were thwarted by a staunchly defended Moselle River line and by old but formidable forts around Metz. Both at Aachen and in the Ardennes the First Army pierced the West Wall in several places, but General Hodges' forces were too greatly extended to exploit the gains. As September passed into October, Allied

**Map 11. ALLIES ADVANCE TO THE GERMAN WEST WALL (Aug. 25–Dec. 15, 1944).** The American breakthrough at St.-Lo and the Canadian-American near encirclement of the German Seventh and Fifth Armored armies in the Falaise pocket had so disrupted the German linear defense that a general withdrawal was forced. The rapidity of the Allied offensive precluded a German reorganization on the Seine, and the withdrawal continued eastward. By September 15, the United States First Army had reached the West Wall in most of its sector; to the north, Field Marshal Sir Bernard Law Montgomery's troops had reached an east-west line through Antwerp, against stiffening resistance; and to the south the Germans had reformed for a stand on the line of the Moselle River and the Vosges Mountains. It was necessary for the Allies to halt, reform, and prepare for major offensives in the north and south in order to close to the line of the West Wall, preparatory to a general advance to the Rhine. This was accomplished in bitter fighting by December 15, except for the area of the Colmar pocket; a small area east and south of Roermond; and the Roer River dams, which permitted the Germans to flood the lower Roer area at will.





armies everywhere had bogged down. While the logistical situation began to improve with time, the German hold on the banks of the Scheldt Estuary continued to deny the use of Antwerp as a port, and until Antwerp could be opened, no sustained offensive could be maintained. Though Montgomery chafed at the assignment of opening Antwerp, preferring instead to make a new attempt to reach the Ruhr from the corridor opened by Operation Market-Garden, he at last turned his full attention to the task in mid-October. Yet it would be a long time before the first Allied ship dropped anchor at Antwerp. Flooding much of the low lying countryside, the Germans fought tenaciously until November 8, inflicting nearly 13,000 casualties on the Canadian First Army. Because the Scheldt Estuary still had to be cleared of mines, Antwerp did not begin functioning as a port until November 28.

In the meantime, encouraged by a steady though unspectacular improvement in the supply situation, Eisenhower had ordered a new offensive to begin in early November, with the main effort to be made by the First Army around Aachen. General Simpson's Ninth Army, which had been moved forward from Brittany, made a supporting attack on the left, while the Third Army launched a similar thrust from the vicinity of Metz. On November 16, the heaviest air bombardment in direct support of troops on the ground to be launched during the war began east of Aachen in support of the First and Ninth armies (Operation Queen). More than 4,000 planes, including 2,400 heavy bombers, dropped over 10,000 tons of bombs on German defenses and communications centers in an effort to repeat the success of the breakout from Normandy. Unfortunately for the success of the attack, Allied commanders had attempted to cover too broad a target area and, in an effort to avoid repeating the costly errors of bombs falling short in Normandy, had allowed too great an interval between the attacking troops and the bomb line. By the time the ground troops could cross this interval, the Germans had recovered sufficiently to remain their posts.

It took all the rest of November and part of December for the First and Ninth armies to build up their forces along the Roer (Rur) River, in places only 7 miles beyond the line from which the offensive began. Even then the armies were powerless to cross the Roer, for a series of dams on its upper reaches remained in German hands and might be blown to flood the valley and trap any force which had moved east of the river.

Farther south the French First Army and the United States Third and Seventh armies had made greater gains, though the Germans still yielded ground only grudgingly. By the end of the first week in December, the two armies of the Sixth Army Group had compressed the Germans into a large bridgehead west of the Rhine based on the city of Colmar (the so-called Colmar pocket), and the Third Army had reached the West Wall along the face of the Saar. The British and Canadians meanwhile had cleared all of the Netherlands south and west of the Maas.

#### GERMAN COUNTEROFFENSIVE AND ALLIED DRIVE TO THE RHINE

**Battle of the Bulge.**—This was the situation on December 16, Hitler struck back with a long-planned counteroffensive. From the gap created in Allied lines it came to be known

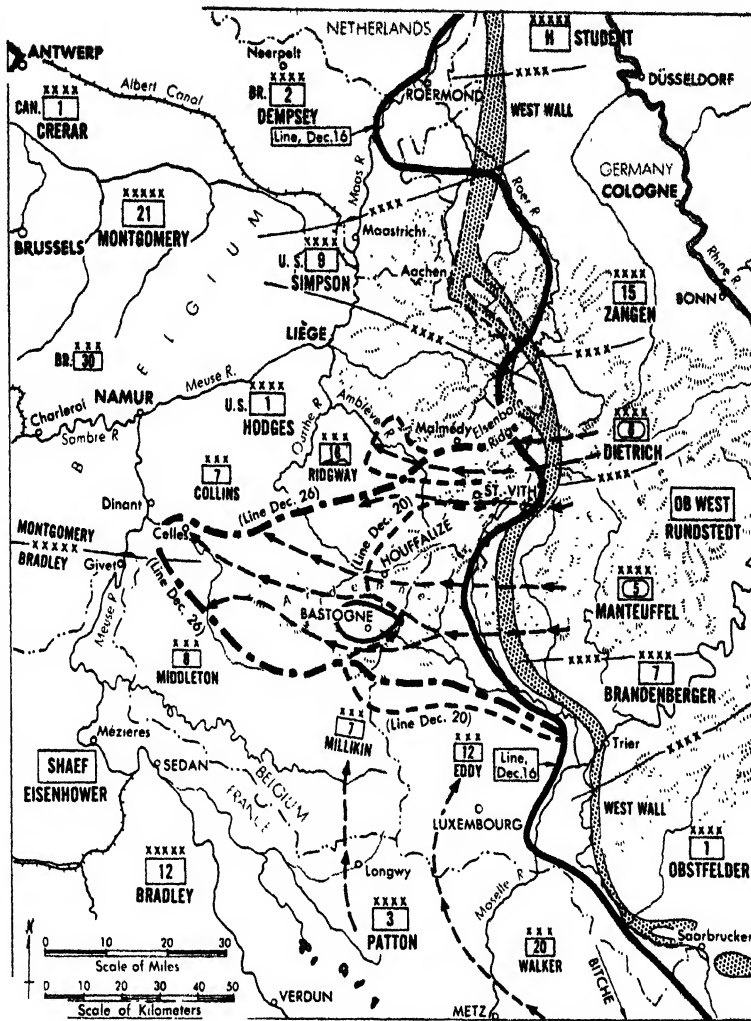
as the Battle of the Bulge. Assisted by the West Wall, excellent defensive terrain along the frontier, and the Allied supply problems, the Germans through the fall had succeeded not only in holding Eisenhower's armies to relatively minor gains; they had at the same time massed behind the front a strong reserve centered around 11 panzer divisions. Hitler intended to strike with this force through the forested Ardennes, cross the Meuse River, and recapture Antwerp, thereby trapping four Allied armies in the north. Though his field commanders deemed the plan too ambitious for the available resources, Hitler would sanction no alterations. After the manner of the German armies in World War I, he took extraordinary precautions to maintain secrecy. Only a handful of commanders knew of the plan until a short while before the target date. Though Allied intelligence early noted the assembling of strong armored forces near Cologne, most intelligence officers assumed that these were intended to counterattack once the First and Ninth armies had crossed the Roer. Fog and snow in the wooded Eifel region opposite the Ardennes successfully cloaked final moves to attack positions. A small force of English-speaking Germans in Allied uniforms early began to infiltrate the lines, later to cause confusion out of proportion to the size of the group. Then, before dawn on December 16, three German armies totaling 25 divisions struck along 70 miles of Ardennes front thinly manned by 6 American divisions.

Making the main effort to seize vital roads in the north, the Sixth Panzer Army under Gen. Sepp Dietrich almost immediately ran into unyielding resistance from the 2d and 99th divisions of Gerow's 5th Corps. For three crucial days these divisions denied the high ground of Elsenborn Ridge and control of the roads Dietrich needed. Only an armored task force called Kampfgruppe Peiper from its commander, Lt. Col. Joachim Peiper, broke through. Committing terrible atrocities against civilians and soldiers, including the murder of close to 100 American prisoners near Malmédy, this force drove more than 15 miles before American reserves bottled it up and clearing weather enabled fighter bombers to wreak havoc on its tanks.

Progress was better in the center, where the Fifth Panzer Army under Gen. Hasso von Manteuffel struck the 8th Corps. Here the American lines were particularly thin, manned by a division seriously understrength from hard fighting in the November offensive and by an inexperienced division only recently arrived from the United States. Everywhere the Germans broke through but at terrible cost. Rallying from early surprise, the Americans threw in small units at critical points to deny the Germans villages, defiles, bridges, and road junctions. Local commanders committed engineer units, quartermaster troops, and even cooks and bakers to the firing line. Though the Germans encircled and captured two thirds of the inexperienced 106th Division in front of the road center of St.-Vith, the division had held its ground long enough for the Twelfth Army Group commander, General Bradley, to rush the 7th Armored Division from a reserve position to hold the town.

The most notable German success occurred south of St.-Vith, where by nightfall of the second day two panzer corps of the Fifth Panzer Army had broken into Luxembourg and headed toward the Meuse River by way of the Belgian road center

**Map 12. GERMAN COUNTERATTACK: BATTLE OF THE BULGE (Dec. 16, 1944–Jan. 31, 1945).** As the Allies threatened the West Wall, Adolf Hitler gathered his last major reserves for a counter-offensive. It was launched in the weakly held Ardennes sector, with the object of driving to Antwerp, splitting the Allied armies, and destroying those in the north. Through surprise it had great initial success, but it was stopped short of the Meuse River because of quick reinforcement of the weak Allied front, insufficient German logistical support to sustain such an extensive drive, and continuous pounding by Allied aircraft. The Allies attacked against the base of the penetration from the north and the south in an effort to trap the German forces, but most of them escaped. The original line was regained by the Allies by January 31, and they then resumed preparations for the crossing of the Rhine and the final offensive in Germany. The net result of Hitler's Ardennes counter-offensive, in which his general reserve was subjected to defeat, was to hasten the end of the war.



of Bastogne. In the meantime, however, General Eisenhower had alerted the only American divisions immediately available as theater reserves, the 82d and 101st Airborne divisions under Maj. Gen. (later Gen.) Matthew B. Ridgway's 18th Airborne Corps. He ordered the divisions to Bastogne, there to be used as the First Army commander, General Hodges, directed. Thus, unknown to either adversary, a race was on for Bastogne.

Eisenhower directed also that Patton call off his offensive against the West Wall in the Saar and turn to strike the south shoulder of the German penetration. Here the German Seventh Army under Gen. Erich Brandenberger, charged with holding the south flank, lacked sizable armored components and had failed to keep pace with the Fifth Panzer Army's advance. As the armored penetration deepened, Eisenhower put all forces north of the bulge under Field Marshal Montgomery, while Bradley retained command of the forces to the south. Montgomery hurried troops of his own 30th Corps to reserve positions west of the Meuse to forestall a German crossing of the river.

As the 82d Airborne Division neared Bastogne, General Hodges ordered the division and headquarters of the 18th Airborne Corps to continue

northward to help support the north flank of the penetration west of Elsenborn Ridge. The 101st Airborne Division, arriving later, was to defend Bastogne. As night came on December 18, the advance guard of the Fifth Panzer Army's panzer columns approached Bastogne, where remnants of American units were holding outposts until the airborne division arrived. By the next morning, American positions were strong enough to discourage the Germans from assaulting the town immediately. Surrounding Bastogne, the bulk of the panzer units continued toward the Meuse, but at critical points they continued to meet small American delaying detachments that demanded a high price in casualties and time before the Germans might pass. The panzer divisions still were a long way from the Meuse when, on December 23, the winter skies cleared, and waves of Allied fighter bombers roared to the attack.

On Christmas Eve an armored spearhead got within 3 miles of the Meuse at Celles but there encountered the United States 2d Armored Division, which had hurried down from the north. In a pitched battle on Christmas Day, the American armor annihilated one German regiment and threw back what proved to be the high-water mark of the counter-offensive. The 2d Armored Division was part of General Collins' 7th Corps which,

along with the 18th Airborne Corps, General Hodges had committed to hold the north flank of the German bulge. There Dietrich's Sixth Panzer Army, finally despairing of taking Elsenborn Ridge, had followed the path of Kampfgruppe Peiper and then tried again to swing northwestward to get across the Meuse. When continued German attacks at St.-Vith at last forced the 7th Armored Division to abandon that town on December 21, additional roads were opened to reinforce Dietrich's thrust. Nevertheless, by December 25 Hodges had formed an unyielding line north of the Amblève River with 8 divisions reinforcing the 2 divisions that still held Elsenborn Ridge. The use here for the first time of a newly developed proximity fuze for artillery shells that exploded them in the air before contact materially aided Hodges' defense. At Bastogne, meanwhile, the Germans had launched an all-out effort to take the town. On December 22, when German emissaries entered the American perimeter with a surrender ultimatum, the American commander, Brig. Gen. (later Gen.) Anthony C. McAuliffe, gave his famous response, "Nuts!"

It was the next day, December 23, that the skies cleared and waves of cargo planes began to resupply the beleaguered troops in Bastogne. The fighting all around the perimeter was fierce, but morale remained high. Then, on the day after Christmas, the 4th Armored Division of Patton's Third Army, having begun to attack four days earlier, broke through to Bastogne from the south. Hard fighting remained before the narrow corridor into the town could be expanded, and the Germans continued through Jan. 3, 1945, to try to take Bastogne, but without success. Having relieved Bastogne, Patton's 3d Corps continued to attack northeastward from the town toward Houffalize in the center of the bulge. Collins' 7th Corps of the First Army began a similar attack toward Houffalize from the north on January 3. The object was to rejoin the First and Third armies and to trap any German units still remaining in the western tip of the bulge. Through intense cold and deep, crippling drifts of snow the American troops fought slowly toward a juncture. At last, on January 16, patrols of the two armies linked at Houffalize. Hitler in the meantime had reluctantly concluded that his bold counteroffensive had failed. On January 8, he ordered Dietrich's Sixth Panzer Army to fall back to a line close to the German frontier and the rest of his forces to evacuate the tip of the bulge. Thus the American pincers which closed on January 16 failed to trap sizable numbers of German troops.

Meanwhile, the 5th Corps of the First Army and the 12th Corps of the Third Army had broadened the Allied offensive to the east and headed toward St.-Vith. At almost the same time, on January 12, the Russians began a new offensive on the eastern front that ripped great holes in the German line. On January 22, Hitler ordered the depleted Sixth Panzer Army to begin moving from the western front to reinforce the east. By the end of January, the American First and Third armies had reached the German frontier to reestablish the line that had existed before Hitler's armies came out of the mists of the Eifel. The net effect of the counteroffensive was to delay Allied attacks about six weeks at a cost to the Germans of more than 100,000 casualties, 600 tanks and assault guns, and about 1,600 planes. The Americans incurred approximately 76,000 casualties.

In launching the counteroffensive, Hitler had counted on surprise and overwhelming initial strength to pierce the thinly manned American positions swiftly and gain the Meuse by the third day. He had failed to reckon on the tenacity of the American troops. Though broken into small, disorganized units, the Americans had continued to fight with élan and determination. Hitler had failed to reckon also on the swiftness with which the Allies could move to counter the early blows. The First Army alone in the first week of the attack moved 248,000 troops and 48,711 vehicles. In one day, December 17, 60,000 men were moved into the Ardennes. Speedy American removal or steadfast defense of major supply depots also hurt the Germans, for in the effort to maintain secrecy most German supplies had been held far back behind the Rhine. After the skies cleared, Allied aircraft scored telling blows on supply convoys treading the icy, winding roads of the Eifel. Though the Luftwaffe mustered surprising strength (as many as 600 sorties a day during the first two weeks), the German planes were overwhelmed by Allied fighter strength. On New Year's Day, in a major attack, approximately 800 German planes caught Allied aircraft on the ground on airfields in Belgium and the Netherlands, but even though they destroyed or damaged 260 planes, the Germans themselves lost 200. These losses the depleted Luftwaffe could ill afford.

The Battle of the Bulge was the greatest pitched battle on the western front in World War II. A total of 29 German and 33 Allied divisions (mainly American) participated. The Germans had created a short-lived bulge in American lines 70 miles wide and 50 miles deep at its westernmost point. They had paid for it with the loss of priceless reserves that left the German Army brittle, ready prey for annihilation once the Allies resumed their offensive in earnest.

**Operation Nordwind.**—In planning for a winter counteroffensive, Hitler at one point had considered striking not in the Ardennes but in Alsace. When the Ardennes counteroffensive began to go badly and it became obvious that Eisenhower was moving divisions from the south into the Ardennes, he looked again toward Alsace. As the plan was finally determined, the German First Army was to attack southward from the West Wall through Bitche and the Wissembourg gap (the latter the site of first German success in the Franco-Prussian War of 1870), while the Nineteenth Army launched a subsidiary thrust northward from the bridgehead around Colmar. The two attacks, under the code name Nordwind, were to link east of the Saverne gap, trapping that part of the United States Seventh Army in northern Alsace and recapturing Strasbourg, a city politically important to the French.

The attacks began just before midnight on December 31, but this time Allied intelligence had determined what was in the offing. The thrust from the Colmar bridgehead gained little ground, and the attack through Bitche was stopped after two days of fighting. But the main force moving through the Wissembourg gap made such gains that General Eisenhower seriously contemplated falling back to a stronger line in the foothills of the Vosges, abandoning Strasbourg. To this the French commanders and the French government reacted with such vehemence that Eisenhower reconsidered. By January 25, the Germans had been stopped with the loss only of

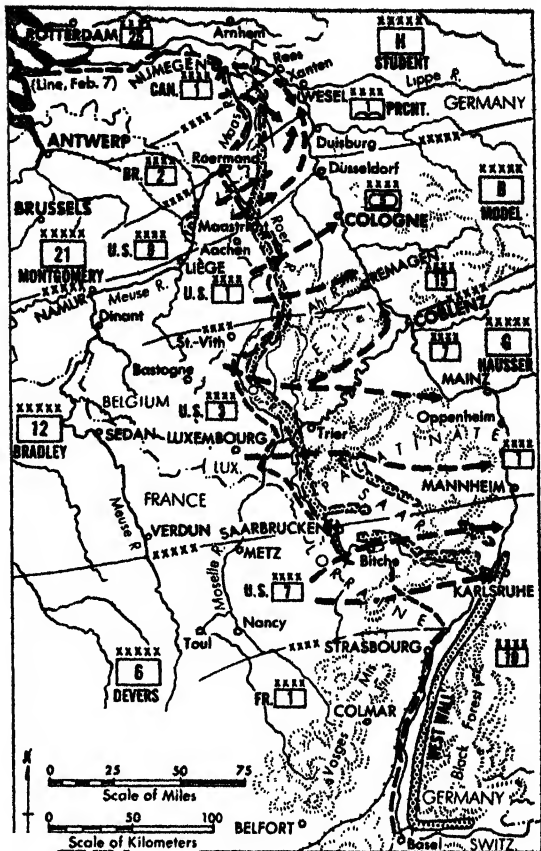
the northeastern corner of Alsace as far south as the Moder River, at the closest point still 12 miles from Strasbourg.

On January 29, the Allied armies in Alsace swung over to the offensive. A week later, United States and French units linked in the center of the Colmar pocket. As the Germans began withdrawing to the east bank of the Rhine, French and United States forces finished clearing the pocket on February 9. The Seventh Army began a drive just over a week later to clear northeastern Alsace and at month's end established a foothold on German soil beyond the Saar River. Though troublesome, Operation Nordwind had failed either to divert any American troops from the Ardennes or to forestall the movement of any units earmarked for that area. The Germans incurred 25,000 casualties; the Americans, 16,000.

**Drive to the Rhine.**—As the First and Third armies eliminated the last of the bulge in the Ardennes at the end of December, General Bradley wanted to continue the attack through the Eifel south of the dams on the upper Roer River, which were still in German hands. Field Marshall Montgomery, on the other hand, demanded that the main effort continue to be made in the north and that Bradley's forces be halted to provide strength there. Though Eisenhower declined to stop Bradley's drive altogether, he too believed the main effort should continue in the north along the most direct route to the Ruhr industrial area. Leaving the Ninth Army under Montgomery's command, he moved divisions from Bradley's First and Third armies to strengthen the Ninth along the Roer River, northeast of Aachen, and told Bradley to mount an attack to take the Roer dams to prevent the Germans from flooding the river.

In the main offensive the Canadian First Army attacked on February 8 (Operation Veritable) from positions near Nijmegen gained in the airborne attack in September. While the Canadians drove southeastward up the west bank of the Rhine, Simpson's Ninth Army on February 12 was to jump the Roer (Operation Grenade) and gain the Rhine near Düsseldorf, and then turn northwestward to link with the Canadians. The Second British Army meanwhile was to push eastward between the other two armies. As the Canadians attacked, they ran into the strongest force left to the Germans in the west. This was Army Group H, organized in the fall under General Student with the First Parachute and Twenty-fifth armies. They also encountered mud, age-old enemy of armies, and low-lying ground flooded by an early thaw. Because the First Army failed to take the Roer dams until the Germans demolished one dam and flooded the river, the Ninth Army could not cross the Roer until February 23. Thus the Germans were able to concentrate additional strength against the Canadians. Gains were short and casualties high.

On the other hand, the shift of German strength to the north meant eventual easier going for the Ninth Army. On the eighth day of attack the army gained the Rhine near Düsseldorf and turned to meet the Canadians. In 11 days the Ninth Army drove 50 miles with fewer than 7,300 casualties, while killing approximately 6,000 Germans and taking 30,000 prisoners. The Canadian First Army had incurred 16,000 casualties. Attacking at the same time as the Ninth Army, a corps of Hodges' First Army also jumped the Roer. Designed originally to protect the Ninth Army's flank, the attack was expanded on March



Map 13. ALLIED ADVANCE TO THE RHINE (Feb. 8–March 21, 1945). Preliminary operations to clear the Colmar pocket and the Roermond triangle and to capture the Roer River dams were generally completed by February 8, and the Allied main operations for the advance to the Rhine then began. They were eminently successful, and by March 21 the Allies occupied the west bank of the Rhine, except for the section to the south between Mannheim and Karlsruhe. During the drive the United States First Army seized a bridgehead across the Rhine at Remagen, and the United States Third Army gained one at Oppenheim. These penetrations on the east bank upset German plans for the defense of the Rhine. Their stubbornness in defending the west bank of the river cost them heavy casualties which, in this final phase of the war, they could not afford.

1, and swept rapidly toward the Rhine against disintegrating resistance. Troops of the 7th Corps entered Cologne on March 5. Over the protests of his field commanders, Hitler steadfastly refused to order a strategic withdrawal behind the Rhine.

Chafing to get into the fight in force, Patton had managed to continue limited offensives in the Eifel that took Trier (March 1) and pushed 15 miles inside the German border. On March 3, the Third Army began a major attack to gain the Rhine north of Coblenz (Koblenz) and link with the First Army along the Ahr River south of Remagen.

As a combat command of the First Army's 9th Armored Division approached Remagen on the afternoon of March 7, the men were astonished to see the Ludendorff railroad bridge across the Rhine still standing. Confused by overlapping command channels and by the recent transfer of the general who had been in over-all charge, the

Germans at the bridge had delayed too long in demolishing it. As a United States platoon rushed toward the bridge, the Germans set off demolition charges, but they failed to do more than damage it. In the face of small-arms fire from the east bank, the American riflemen charged across the bridge. In a matter of minutes the Allies had a bridgehead beyond the Rhine. Though General Eisenhower had intended no crossing in the Remagen area, he acted quickly to exploit the coup. Three days after the first crossing, the First Army had 1 armored and 3 infantry divisions across the river. Denuding other parts of the Rhine front, the Germans launched savage attacks against the bridgehead, but to no avail. Though the Luftwaffe tried time after time to destroy the bridge from the air, it stood until March 17. Weakened by hits from long-range artillery, the Ludendorff bridge collapsed that day, but by then engineers had spanned the river in other places.

Patton's Third Army meanwhile had pierced the Eifel with swift armored thrusts that trapped thousands of Germans and cleared the entire region north of the Moselle by March 11. Patton turned then to jump the Moselle and assist Patch's Seventh Army in sweeping the Saar and the Palatinate. This was accomplished by March 25 at a cost to the Germans of 100,000 prisoners. In the entire battle of the Rhineland, the Germans lost more than 250,000 men. Even before the Saar region was clear, Patton launched a surprise thrust across the Rhine. Shortly before midnight on March 22, the 5th Division sneaked across near Oppenheim against only scattered small-arms fire. Before daylight of March 23, 6 infantry battalions were on the east bank at a cost of only 28 casualties.

With the clearing of the Saar and the Palatinate, Allied armies held the west bank of the Rhine from Arnheim to the Swiss border. Except for fortifications on the east bank from Karlsruhe to Switzerland, the West Wall lay behind. Gone too were the days of painfully slow advances through mud, ice, and snow. And through it all the mammoth aerial campaign continued, turning German cities to rubble. In one day in March, Allied planes flew 11,000 sorties. Though on the German side jet-propelled fighters at last began to take to the skies in impressive numbers, they were too late to change the course of the war. By the end of March, after dropping a record 245,000 tons of bombs during the month, Allied strategic bombers were almost out of targets. The German units that managed to escape to the east bank of the Rhine made an impressive array on paper, but in reality they equaled only about 26 complete divisions. General Eisenhower's forces meanwhile had increased to 85 divisions, 5 of them airborne and 23 of them armored. His total command now numbered 4,000,000 men.

On March 10, soon after loss of the Remagen bridge, Hitler relieved Field Marshal von Rundstedt as commander in chief in the west. In his place he installed Field Marshal Albert Kesselring, former German commander in Italy. But it would take more than a new commander to bring any order out of the chaos that now enveloped the German armies in the west. Army Group G in the south was weakest of all. Army Group B in the center, preoccupied with the Remagen bridgehead, was in no position to stop a major attack to break out of the bridgehead.

Only Army Group H in the north with the First Parachute and Twenty-fifth armies had any real strength left. Committed to protect the vital Ruhr industrial area, even this group was thinly spread.

In contrast to American commanders, Field Marshal Montgomery left nothing to chance in his preparations to put his Twenty-first Army Group across the Rhine (Operation Plunder). Air attacks to isolate the battlefield began two weeks before the target date for the crossing, and the First Allied Airborne Army was assigned to drop 2 airborne divisions in support of the operation. A smoke screen 50 miles long covered the preparations. Behind heavy artillery fires the British Second Army started crossing the Rhine between Xanten and Rees soon after nightfall on March 23. Before daylight the next morning, the Ninth Army also began to cross the river south of Wesel. The Ninth Army in particular met limited opposition. The army's casualties for the first day were 41 killed, 450 wounded, and 7 missing, surprisingly low for an attack against a defended river line. The airborne divisions—1 United States and 1 British—began landing in midmorning of March 24, and by nightfall both were in contact with British ground troops. By the end of the day the two Allied armies had established a firm bridgehead as deep as 6 miles in places.

#### VICTORY IN THE WEST

**Drive to the Elbe.**—The unqualified success in the north was the signal for all Allied armies to begin the victory sweep through Germany. While approving a plan for the Ninth and First armies to encircle the Ruhr, with the former remaining under Montgomery's command, General Eisenhower directed that as soon as the Ruhr was secured, the Ninth Army was to revert to Bradley's Twelfth Army Group. Bradley's armies then were to make the main Allied effort along the Erfurt-Leipzig-Dresden axis to link up with the Russians.

The Third Army began to exploit its Rhine crossing on March 25, and the next day seized a bridge across the Main River near Frankfurt and entered the outskirts of the city. On March 29, the First and Third armies linked their bridgeheads near Wiesbaden. The Seventh Army in the meantime made an assault crossing of the Rhine on either side of Worms before daylight on March 26. Other troops of the army crossed near Mannheim, and on April 1 entered Heidelberg. Alarmed lest the French be denied a major role in the push through Germany, General de Lattre speeded the attack preparations of his First Army, crossed the Rhine before daylight on March 31 near Speyer, and turned southward toward Stuttgart.

The reaction of the German High Command to the advances of the Sixth Army Group was typical of that all along the front. Hitler and his entourage in OKW seemed incapable of comprehending the extent of German losses and reverses. Unable to make additional troops available, OKW insisted nevertheless that Army Group G counterattack northward to cut off the Sixth Army Group columns. When this proved impossible, OKW relieved the group commander. Hitler had already tried to form a *Volkssturm* (People's Army), but in almost every case these untrained, ill-armed, poorly equipped troops put up little fight. He called now for the formation



of an underground army of "Werewolves" to fight the invading armies by any and all methods. It was a dramatic appeal, but it produced few tangible results.

In the north, Simpson's Ninth Army and Hodges' First Army swept rapidly toward a juncture on the east face of the Ruhr industrial area near Paderborn. The drive gained speed from the fact that the Army Group B commander, Field Marshal Model, had disposed his remaining defenses facing southward against the Remagen bridgehead and thus was ill prepared for the First Army's push to the east. What was more, the First Army drive severed all contact between the forces of Army Group B and Army Group C. Similarly, Army Group H north of the Ruhr was powerless to stop the eastward push of the Ninth Army. Though the commander, General Student, begged permission to fall back behind the Weser River and to withdraw forces from the Netherlands to help build a new line, Hitler and OKW rejected the requests. Armored spearheads of the two American armies met at Lippstadt, 17 miles west of Paderborn, on April 1 to complete what General Eisenhower called "the largest double envelopment in history." Caught in the Ruhr pocket was all of Army Group B with its Fifth Panzer and Fifteenth armies and part of Army Group H's First Parachute Army.

After attempting without success to break out of the pocket, first to the north and then to the south, Field Marshal Model settled down to fight to the end, hoping thereby to tie up as many Allied troops as possible. But the end was not long in coming. On April 14, the Americans cut the pocket in two. Two days later the eastern half collapsed, and on April 18 all the remaining garrison surrendered. The final count of prisoners exceeded 325,000. Model himself was reputedly a suicide. A new United States army headquarters, the Fifteenth under General Gerow, former 5th Corps commander, came forward to supervise the final mopping up, while the First and Ninth armies continued to the east.

As all Allied armies spread out over Germany, their advances exceeded even those of the great pursuit across France. Drives of 35 to 50 miles a day were not uncommon. Armored divisions usually led the way, but infantry units too, the men mounted on attached tanks or tank destroyers or riding trucks normally used to tow artillery, made rapid dashes. Many towns and villages lay undefended. All that stood in the way of capturing others were roadblocks hastily constructed of heavy logs. Demolished bridges caused the greatest delays, but with the Germans able to form no solid line even behind sprawling streams like the Weser, infantrymen quickly paddled across in assault boats to form a bridgehead while engineers often in less than half a day constructed pontoon bridges that tanks and other vehicles might use. White flags raised by an apathetic and supine citizenry flew from every building. In most cases the Germans put up a half-hearted resistance and then merely waited for the Allied flood to roll over them. In others some local commander might instill his troops with special bravado and bring on a fierce little engagement in the midst of an otherwise unimpeded advance. This happened at Kassel and left the city in ruins. It happened also at Heilbronn on the Neckar River, where

the Seventh Army required a week to reduce the city. It happened too in the Harz Mountains, where contingents of the First Army also found themselves involved for a full week in a real war again.

On the *Reichsautobahnen*, the superhighways with which Hitler had laced the country for moving his military forces, Allied columns roared up all four lanes, while crowds of dejected German prisoners or ragged but exuberant slave laborers of almost every nationality in Europe marched westward down the median strip. Some units overran vast caches of money and works of art looted by the Nazis from all corners of occupied Europe. Others came across walking skeletons who somehow had survived the Nazi concentration camps and mute but grim evidence of human extermination factories. Supplying the far-ranging motorized columns was a tremendous, fantastic task. The most critically needed supplies—gasoline, rations, and ammunition—usually came in by cargo planes to newly captured airfields. Heavily laden trucks with headlights ablaze in disdain for whatever might remain of the Luftwaffe roared through the night on the autobahns. Trucks often had to make 700-mile round trips to railheads along the Rhine. The first two rail bridges built across the river were opened on April 8 at Wesel and on April 14 at Mainz.

In the north the British Second Army bridged the Weser on April 5 and reached the Elbe by April 24. Despite stiff resistance along the Dortmund-Ems Canal, a column on the British left advanced to Bremen by April 20, there to fight a week-long battle against a group of diehard defenders. The columns on the right jumped the lower Elbe on the last two days of April, and on May 2 took Lübeck without opposition, thereby cutting off the peninsula of Schleswig-Holstein and Denmark. The great port of Hamburg surrendered the next day, also without a fight.

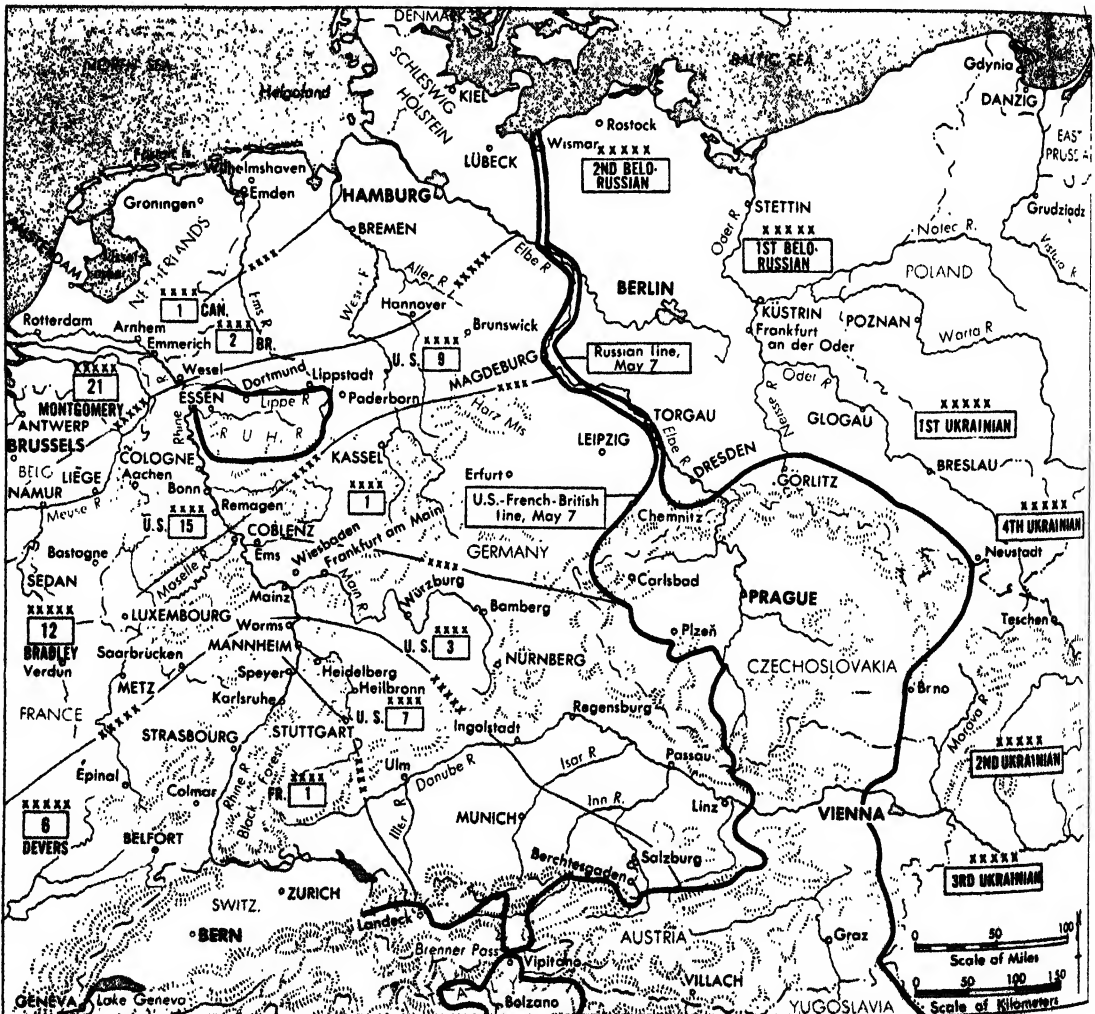
The Canadian First Army, driving to cut off the Germans in the Netherlands, engaged in some of the heaviest fighting of all during the first few days of April. From a Rhine bridgehead near Emmerich one column established a bridgehead over the Ems River on April 8, and then ran into one sharp fight after another en route to the naval bases at Emden and Wilhelmshaven. To the west another column driving due north from Emmerich quickly reached the North Sea, cutting what remained of German forces in the northeastern Netherlands into ineffective pockets. Still a third force farther west jumped the Lower Rhine on April 12, cleared Arnhem two days later, and reached the IJsselmeer on April 18. Four days later, Allied commanders, all too aware of the misery already besetting the Dutch people for lack of food, suspended attacks on the promise of the German high commissioner for the Netherlands, Arthur Seyss-Inquart, that he would avoid wholesale flooding of the low-lying country. After a meeting between Seyss-Inquart and Eisenhower's chief of staff on April 30, the Allies began a program to deliver food and supplies to the hard-pressed Dutch, but the Germans in the Netherlands refused to surrender so long as the German government had not capitulated.

In the Allied center troops of the First and Ninth armies were already on their way to the Elbe even before the final capitulation in the

cate that the Germans were in a last-ditch defensive position in the Alps, the so-called National Redoubt. The Ninth Army was to halt at the Elbe, Eisenhower directed, and the First Army at the Mulde, a tributary of the Elbe. There to await contact with Soviet armies from the east. The First Army took Leipzig on April 18. Already an armored division had bypassed the city to reach the Mulde River. Patrols sent out by both the First and the Ninth armies made contact with forward Soviet units on April 25, while the first formal meeting between United States and Soviet divisional commanders took place near Torgau on the following day. Meanwhile, the Third Army had

Meanwhile, the Third Army had pressed on to the Czechoslovakian border. With the First and Ninth armies established on their final objectives, Eisenhower directed the Third Army to sideslip southward for drives into Czechoslo-

Map 14. COLLAPSE OF GERMANY (March 21-May 7, 1945). The first Allied objective in the crossing of the Rhine was to encircle the rich industrial Ruhr. Field Marshal Sir Bernard Law Montgomery was scheduled to make the main attack in the north, and Gen. Omar N. Bradley a secondary attack to the south. The spectacular successes of Bradley's Twelfth Army Group, however, altered the Allied plan so that Bradley was to make the main attack. On April 1, elements of the United States Ninth and First armies met at Lippstadt to complete the encirclement. By April 18, the Ruhr had been captured, and the Germans had lost 325,000 men and vast stores of supplies and equipment. Meanwhile, the general advance continued to the Elbe, while the United States Third Army struck for Vienna and the Sixth Army Group for western Austria and the Brenner Pass. On April 25, American and Soviet forces met at Torgau. When the Germans surrendered on May 7, the Allied forces had advanced to the lines shown.





Nürnberg before and after the war. Above: At the annual rally of the National Socialist Party in September 1938, storm troopers parade through the streets of the city, passing in review before Adolf Hitler. Right: German civilians stand amid the ruins of their city, which fell to the United States Seventh Army in April 1945.



(Above) Wide World; (right) Robert Capa-Magnum

vakia, Bavaria, and Austria close beside the Seventh Army. The attack picked up momentum on April 22 and began to make the usual rapid gains at extremely low costs in men. One day, for example, the entire Third Army lost only 3 men killed, 37 wounded, and 5 missing while taking 9,000 German prisoners. Breaking through hastily improvised defenses on the Isar and Inn rivers, contingents of the Third Army on May 4 seized Linz, Austria. Others pushed into Plzeň (Pilsen), already in the hands of Czech partisans.

The two armies of General Devers' Sixth Army Group meanwhile had swung southeastward from their Rhine bridgeheads to sweep to the Swiss border and eventually to enter Austria and link with Allied forces in northern Italy. In addition to a hard fight at the Neckar, troops of the Seventh Army had to battle three days for Nürnberg but took the city on April 20. The French swept through the Black Forest on the east bank of the Rhine, and on April 22 took Stuttgart. As the Seventh Army headed into southern Bavaria and the Austrian Tirol to forestall any establishment there of a National Redoubt, both armies crossed the Danube on April 22. Munich (München) fell on April 30 and Salzburg on May 4, and with the aid of Austrian partisan guides a column pushed to the Brenner Pass on the same day. Berchtesgaden, site of

Hitler's mountain retreat, also fell on May 4. The myth of a National Redoubt exploded. Nowhere was there evidence that the Nazis had made preparations for a last-ditch stand.

**End of Hitler.**—The precise time when Hitler realized that the end was near is hard to place, but by mid-April it was clearly apparent to him that Allied and Soviet armies soon would split Germany in two. Reserving for himself the right to command in whichever part of Germany he happened to find himself when the split came, he designated Admiral Doenitz, head of the German Navy, to command in the north should the führer be in the south. Similarly, he designated Field Marshal Kesselring to command in the south should he himself be in the north.

By April 22, with Berlin under direct attack from the Soviet Army since April 16, Doenitz, Goering (heir designate to Hitler's post), and most other ranking officials had left Berlin for either the south or the north. Hitler and his military staffs were about all that remained. The führer apparently had high hopes of prolonging the war indefinitely until April 22, when a counterattack which he had ordered to strike the Russians at Berlin from the north failed to materialize. From this point he vowed to stay in the capital, eventually to kill himself rather than to fall into the hands of his enemies.

Learning the next day of Hitler's decision to stay in Berlin, Goering assumed that it was time he took control of the government. When he radioed for instructions, saying that if he received no answer during the day of April 23, he would take charge, Hitler considered the act treasonable. He promptly had Goering arrested. By the end of April, all concerned had to admit that every effort to relieve Berlin had failed, and that the city was facing its final fight. Hitler himself, having composed a will designating Doenitz his successor as head of the German state and supreme commander of the armed forces, committed suicide.

**German Surrender.**—The possibility of large-scale but piecemeal surrender had been growing since mid-April, but because the Russians were suspicious lest the Germans make peace with the Allies while continuing to fight the Soviet armies, the Allies rejected most overtures. As early as April 23, Heinrich Himmler, head of the *Waffen-SS*, an elite ancillary force of the German Army, offered to arrange a surrender on the entire western front, but the heads of Allied governments replied that unconditional surrender on all fronts, made in agreement with the Allies and the Soviet Union, was the only acceptable course.

Aware of the agreement between the Western Allies and the Soviets, Admiral Doenitz nevertheless hoped to save as many German troops as possible from falling into the hands of the Soviet Army. When the Allies on April 29 accepted the surrender of German forces in Italy to become effective on May 2, he began to explore the possibility of other piecemeal surrenders. This led on May 4 to the surrender of all forces in the north, including Denmark and the Netherlands, to Montgomery and the Twenty-first Army Group, though the terms stipulated that the capitulation would be superseded by any general instrument of surrender later to be signed. The next day, a similar surrender occurred in the south, where Army Group G capitulated to the Sixth Army Group.

A German representative authorized to open negotiations for all remaining forces in the west arrived at General Eisenhower's headquarters in Reims on May 5. Recognizing that the German

scheme was to gain time in which to bring troops facing the Russians into the western zone, Eisenhower informed Moscow that he had no intention of accepting surrender unless it included simultaneous surrender to the Soviets. The Russians in turn authorized Maj. Gen. Ivan Susloparov, already at Eisenhower's headquarters, to act for them. The negotiations began in the late afternoon of May 5. When General Eisenhower made it known that unconditional simultaneous surrender on all fronts was the requirement, the head of the German delegation wired Doenitz for approval. The admiral and those around him were shocked. Doenitz hastily sent General Jodl, head of the OKW operations staff and a strong opponent of surrender in the east, to continue the negotiations at Reims.

When Jodl arrived, he found Eisenhower unyielding. Unless the Germans agreed quickly to surrender, Eisenhower said, he would break off all negotiations and seal the western front to prevent the further westward movement of German troops and civilians. Even Jodl, steadfast opponent of over-all surrender though he was, was impressed. He telegraphed Doenitz for permission to sign. The Germans signed at 2:41 A.M. on May 7. The next day, May 8, the Allied chiefs of staff designated V-E (Victory in Europe) Day. A second surrender ceremony, with ranking Russians in attendance, took place in Berlin on May 9.

**Accomplishments and Cost.**—As hostilities came to an end, the German war machine and the German nation were crushed to a degree never before experienced in modern times. With the prior surrender of Army Groups B, G, and H and with the steamroller advance of the Soviet armies, no organized military units remained at the time of the over-all surrender except in Norway and in Czechoslovakia and the Balkans. These were incapable of more than a week or two of resistance even had they chosen to prolong the fight. Though some jet fighter aircraft remained, the Luftwaffe was too demoralized even to make a final suicidal effort. What was left of the German Navy lay helpless in the captured northern ports. Hitler's Germany was prostrate, beaten by powerful Soviet armies and by an Allied force that at war's end totaled



Allied and German representatives prepare to sign the surrender document at Reims on May 7, 1945. On the far side of the table, from left to right, are Lt. Gen. Sir Frederick E. Morgan, Maj. Gen. François Laurent Sevez, Adm. Sir Harold Burrough, Lt. Gen. Walter Bedell Smith, Maj. Gen. Ivan Susloparov, Gen. Carl Spaatz, and Air Marshal Sir James M. Robb; at the foot of the table are Col. Ivan Zenkovich (foreground) and Maj. Gen. Harold R. Bull. Seated on the opposite side is the German delegation: from left to right, Adm. Hans von Friedeburg, Col. Gen. Alfred Jodl, and Maj. Wilhelm Okenius.

Acme Photo

**Map 15. ALLIED OCCUPATION ZONES.** At the Yalta Conference in February 1945, the three principal Allied leaders—Franklin D. Roosevelt, Winston Churchill, and Joseph Stalin—finished the assignment of occupation zones in Germany and Austria to the several powers. The map shows the areas assigned. The capitals of Berlin and Vienna were to be jointly occupied by the Americans, British, French, and Russians and governed under four-power commissions. In order to permit access to the isolated American zone, the port and enclave of Bremen were assigned to the United States, with rights of access to the United States zone through the British zone. Each nation had right of access to jointly held Berlin and Vienna. At the Potsdam Conference in July–August 1945, the new Western leaders, Harry S. Truman and Clement R. Attlee, agreed reluctantly to Polish "administration" of the territory in the Soviet zone of Germany as far west as the Oder-Neisse line, as shown. In addition, East Prussia was divided between Poland and the USSR.



4,581,000 men in a balanced air-ground military machine. Under Eisenhower's command on V-E Day were nine armies, 23 corps, and 93 divisions and air strength totaling 17,192 planes. Since D-day in Normandy the Germans in the west alone had lost 263,000 dead, 49,000 permanently disabled, and 8,109,000 captured. Allied casualties were 186,900 dead, 545,700 wounded, and 109,600 missing (some later declared dead and others later repatriated as prisoners of war).

Any analysis of the victory must begin with the stubborn refusal of Britain and the Soviet Union to yield early in the war when the odds against them appeared overwhelming, and it must include the vast contribution by the United States both in manpower and as the arsenal of democracy. United States troops comprised more than two thirds of Eisenhower's command at the end of the war. During the last two years alone, American factories produced for the British 185,000 vehicles, 12,000 tanks, and enough planes to equip four tactical air forces; for the Russians, 247,000 vehicles, 4,000 tanks, and enough planes to equip two tactical air forces; and for the French, all weapons and equipment for 13 divisions and their logistical and air support. Thus, unlike the situation in World War I, when the American contribution was relatively small and merely provided the tilt in the balance of power, the reconquest of western Europe in World War II saw a predominant American contribution.

Though airpower failed to prove the decisive instrument that its more outspoken prewar advocates had predicted, it was a major factor in the Allied victory. The naval role was vital as well, for without control of the sea lanes, Allied power could not have been concentrated in England, and without the landing craft, amphibious doctrine, and fire support provided by Allied navies,

the assaults against the beaches of Normandy and southern France could not have been staged. But it was not until Allied ground troops fought their way to a juncture with the Russians that Germany's will was broken.

Throughout the war, Hitler and much of the German nation put their faith in miracle weapons that never came. Postwar revelations have shown that the Germans had not advanced as far toward an atomic bomb as Allied intelligence had feared. The only spectacular accomplishments in miracle weapons were the V-1 (flying bomb) and the V-2 (supersonic rocket). Between June 1944 and March 1945, when the last of the launching sites were overrun, the Germans fired 18,300 V-1's and 3,000 V-2's, about equally divided between England and targets on the Continent, notably Antwerp. They inflicted 33,400 casualties in England and about 13,000 on the Continent, but never seriously affected the military campaign other than to divert antiaircraft troops and radar equipment to the defense of London and Antwerp.

In quality of weapons and equipment the greatest Allied advantage over the Germans was in heavy bombers and long-range fighters, an achievement never seriously challenged by the Luftwaffe despite the German development of the first supersonic rocket and the first jet-propelled aircraft. In all cases these came too late to affect the outcome of the war. In artillery, mortars, and machine guns both sides were relatively equal, though a technique of massed artillery fire used by the British and Americans was a noteworthy achievement. The Americans enjoyed some firepower advantage with a semi-automatic rifle, but a German machine pistol widely used in rifle battalion; drew the respect of all Allied troops. German tanks throughout the war were superior to the Allied mainstay,



the United States Sherman, both in armor and armament, and the German 88-mm. gun, effective against tanks, aircraft, and personnel, was the World War II equivalent of the French 75. American motor vehicles, particularly the highly serviceable two-and-one-half-ton truck, made the Allies markedly superior in the field of motor transport and were in a large measure responsible for fantastic Allied achievements in the field of logistics. The combined staff system of the United States and Britain provided a unity of command and purpose never approached on the Axis side.

See also sections 12. *Developments in Naval Warfare*, 13. *Developments in Air Warfare*, and 17. *Costs, Casualties, and Other Data*; separate biographies of the leading military and political figures; BELGIUM—5. *History* (Belgium in World War II); FRANCE—32. *History: World War II and the Postwar Period, from 1940* (France Defeated and Resurgent); GERMANY—4. *History Since 1850* (Hitler's Third Reich, 1933–1945); LUXEMBOURG—*History*; NETHERLANDS—*History* (Development Since World War I).

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## 6. German Invasion of the USSR

The summer of 1940, after France had surrendered, found Adolf Hitler in a quandary. He had won three whirlwind campaigns, but the next in logical order, the reckoning with Great Britain, was one for which he had little stomach. By his own admission he was a lion on land but a coward on water, and he began planning for an invasion of the British Isles with scant enthusiasm. At the same time he toyed with other projects: the capture of Gibraltar or the Suez Canal, a landing at Haifa, a North African campaign. None of these was significant enough to resolve any of his major problems: how to dispose of Britain; how to secure the *Lebensraum* (space for living) for which the war was ostensibly being fought; how to end the war on German terms before the United States could arm and intervene; how to deal with the Soviet Union, a "friend" he neither liked nor trusted. Most pressing at the moment was the question of Britain. Poland, Norway, Denmark, the Netherlands, Belgium, Luxembourg, and part of France were occupied, but the British showed no inclination to quit. The more he thought it over, the more Hitler became convinced that the British hoped eventually to find an ally in the USSR. If that were true, then the way to bring the British to heel quickly was to remove their last hope.

### GERMAN PLANS AND ATTACK: 1941

Exactly when Hitler decided that he would have to fight the Soviet Union is a moot question. The idea of an inevitable clash between nazism and Soviet communism was one of the least ambiguous tenets of his political philosophy. If, during the period of the Nazi-Soviet Pact, he did not talk about it, he also did not renounce it. On the other hand, it cannot be assumed that, turning against the Soviet Union when he did, Hitler was merely executing part of a pre-conceived program. As in nearly all of his decisions,

there was a progression involving the original idea, a specific strategic concept, events and circumstances that seemed to him to confirm the validity of the first two steps, and, finally, a period in which he developed an unshakable determination to see the enterprise through.

The idea of inevitable conflict with the Soviet Union Hitler had expressed in *Mein Kampf*. In July 1940, the apparent stalemate in the war with Britain brought the Soviet Union to the forefront of his strategic thinking as an inviting target in itself, as the last obstacle to German hegemony on the Continent, and as the lever with which to bring Britain to terms. At the same time, by acting as an equal—even an independent—partner, the Soviet government appeared to confirm the line of thought which he had begun to follow. In June 1940, during the week before the Franco-German armistice, Soviet troops occupied Lithuania, Latvia, and Estonia. The secret protocol to the 1939 pact placed the three Baltic states in the Soviet sphere of influence, but the Russians' timing was a disquieting sign that they intended to take their share of every German victory. At the end of June, the Russians forced Rumania to cede Bessarabia and northern Bucovina to them, a step that brought them closer to the Rumanian oilfields, on which the Wehrmacht was heavily dependent. Then, in July, the Soviet government renewed its pressure on Finland. By treaty Finland was in the Soviet sphere of influence, but in occupying Norway Germany had secured an access route to the Finnish nickel-mining region near Petsamo (now Pechenga) on the Arctic coast, and in July 1940 the German firm I. G. Farbenindustrie signed a contract for the entire output of the Finnish mines.

As early as June of that year, the German Army General Staff was speaking of the USSR as the possible next scene of operations. On July 21, toward the end of a conference regarding the projected invasion of the British Isles, Hitler instructed the commander in chief of the army, Field Marshal Walther von Brauchitsch, to begin planning a campaign against the Soviet Union. Ten days later, on July 31, in another conference concerned mostly with the war against Britain, Hitler declared that a reckoning with the Soviet Union was necessary. He said that he had wanted to proceed with it that fall, but because of the severe Russian winters had decided to wait until May 1941. The operation would have to be swift and final, and he was allowing five months for its completion. Any longer period would involve the army in winter warfare and might give the British and Americans time to intervene. In these two almost casual statements Hitler, if he had not made an irrevocable decision (and perhaps he had not), at least set a course from which he never later saw any reason to deviate.

On August 1, Col. Gen. Franz Halder, chief of the Army General Staff, described to Gen. Erich Marcks a campaign against the Soviet Union employing two army groups, one striking toward Moscow (Moskva) and the other toward Kiev. He assigned to Marcks the task of developing the details. By August 5, Marcks had completed a plan that called for a main effort directed toward Moscow, a secondary effort in the south in the direction of Kiev, and a subsidiary thrust toward Leningrad. There was still much planning to be done, but the Marcks program did establish

army's concept of Moscow as the outstanding strategic objective.

A visit by Foreign Commissar Vyacheslav M. Molotov to Berlin on Nov. 12-13, 1940, produced the first overt signs of a rift between Germany and the USSR. The purpose of the visit was to discuss the Soviet Union's joining Germany, Italy, and Japan in a four-power alliance. Molotov came armed with demands and complaints. He wanted to know whether Germany intended to honor her treaty obligations with respect to Finland. Lately, in his opinion, the Germans had shown too great an interest in that nation, and the Soviet Union intended to intervene there as it had in the Baltic states. The Soviet government also wanted bases in Bulgaria and control of the Dardanelles. Hitler, on the other hand, talked glowingly of Soviet expansion to the east, into India for instance, and he issued a thinly veiled warning that he would not tolerate further Soviet encroachments in Europe. Concerning Finland, he stated that any new disturbance in the Baltic area would place a heavy strain on German-Soviet relations. The meeting had a definite, if subtle, effect on both partners. The Russians continued to maneuver diplomatically but carefully avoided overt acts. Hitler was thoroughly annoyed at the Russians' display of grasping independence, and he believed that they would not have dared to assert themselves as they had without a secret agreement with the British.

**Preparation of Operation Barbarossa.**—On Dec. 18, 1940, Hitler signed Führer Directive No. 21, subtitled "Operation Barbarossa." The directive, which was based on the work of several planning groups, was the strategic outline for a campaign against the Soviet Union. It laid down a plan for a two-phase operation. In the first phase the German Army was to engage the Soviet main force as close to the western border of the Soviet Union as possible, cut it up by encircling movements, and destroy it and so prevent the Russians from fighting a delaying action across the vast spaces of their country. The second phase would take the form of a rapid pursuit to a line running north and south from the Volga River to Arkhangelsk (Archangel). The destruction of the Urals industrial area farther east could be left to the Luftwaffe.

The directive divided the German forces into three army groups, two north of the Pripyet (Pripyat) Marshes and one to the south. The northernmost army group would strike toward Leningrad, the one in the center toward Smolensk, and that in the south toward Kiev. The central army group would be the strongest, but after the attack began, it might be required to divert some of its strength to help its neighbor on the north toward Leningrad. Hitler had included this idea over the almost unanimous opposition of his generals, but in a sense he was taking the more orthodox view. Leningrad, Smolensk, and Kiev were situated at nearly equal distances from the frontier; therefore, in the light of the over-all strategy, they should have been taken before the army drove deeply into the interior. The generals, on the other hand, had the better argument. In their opinion the main force had to be directed without any diversions toward the primary objective, Moscow, for it was there that the decisive battle would be fought after the Russians had been forced to concentrate all of the forces they could assemble

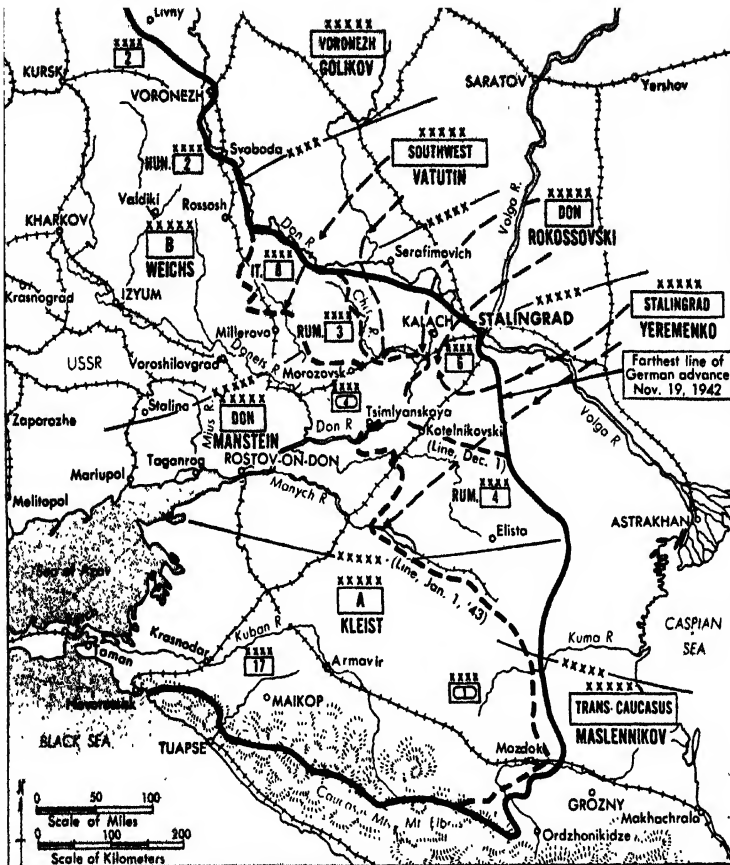
to defend the capital and hub of the country's communications systems.

In the directive, Hitler also stated that Rumania and Finland were to be considered prospective allies in the war against the Soviet Union. Arrangements would be made with both countries in due course. Hitler instructed the German Army of Norway to be prepared to occupy the Petsamo region and to conduct an offensive from Finland to cut the Murmansk (Kirov) Railroad.

Toward the end of January 1941, the Army General Staff completed an operations order that assigned specific missions to the various army groups. Army Group North, commanded by Field Marshal Wilhelm von Leeb, was to attack from East Prussia toward Leningrad. It would place its greatest strength on its right flank and turn to the left, driving the Russian defenders back against the Baltic coast. Army Group Center, under Field Marshal Fedor von Bock, operating north of the Pripyet Marshes, would employ strong tank forces to complete two giant encirclements, one closing near Minsk and the other east of Smolensk. The final decision as to whether this group would continue directly toward Moscow or halt at Smolensk and divert forces to Army Group North could be avoided, since it was contrary to German staff practice to carry definitive planning past the first phase of an operation. Army Group South, commanded by Field Marshal Gerd von Rundstedt, was to attack from southern Poland and Rumania, its flank armies converging on Kiev to trap the Soviet armies in the western Ukraine in a great pocket west of the Dnieper (Dnepr) River. (In March, Hitler became convinced that the southern flank army would not be able to fight its way across the Dniester or Dnestr River; consequently, he assigned to the army on the north the mission of striking toward Kiev and then sweeping southward inside the great bend of the Dnieper.) At a conference on February 3, General Halder summarized the plan for Hitler and informed him that the first echelon of troops was moving into assembly areas behind the frontier. At the close of the conference, Hitler approved the operations order and declared, "The world will hold its breath when Operation Barbarossa begins."

The first starting date set for Operation Barbarossa was May 15. The plans had provided time for a preliminary campaign in Greece, but when Yugoslavia was added to the Balkan campaign after the anti-Axis coup of March 26-27, the timetable had to be revised. Barbarossa was postponed to June 22.

Within the small circle of high-ranking officers and government officials who knew about Barbarossa, opinions varied. Although some of the generals occasionally expressed random doubts, once the planning was well under way, most of them came to share the view of General Halder that the campaign would be completed in 8 to 10 weeks. A notable exception was the military attaché in Moscow, who believed that Soviet industrial capacity, particularly that east of the Urals, was being greatly underestimated. Members of the German Foreign Office contended that so much could be obtained from the Soviet Union by political means that a military conquest was superfluous. The German ambassador to the Soviet Union told Hitler that Joseph Stalin "would give the shirt off his back" to avoid a



Map 22. GERMAN DISASTER AT STALINGRAD (Nov. 19, 1942-Jan. 31, 1943). On Nov. 19, 1942, the Russians launched strong offensives on both sides of Stalingrad. By November 22, the German Sixth Army and half of the Fourth Panzer Army had been encircled and cut off. Plans to permit an attempt to break out to the rear met with Adolf Hitler's stern order to stand fast. On Jan. 31, 1943, most of the remnants of the Sixth Army, starving and half frozen, surrendered to the Russians (one pocket held out until February 2). In the meantime, the Soviet offensive had intensified on the flanks of the Stalingrad front. It was clear to the Germans that the objective was to drive to Rostov-on-Don and cut off their Army Group Don and Army Group A. The latter, with its front 350 miles southeast of Rostov, was indeed in a dangerous position when the Sixth Army surrendered, thus freeing large Soviet forces for the drive to Rostov.

the German remnants of Army Group B and Army Group Don, which was still endeavoring to hold open Army Group A's lifeline to the west at Rostov.

On January 25, the Russians struck northward once more to hit the German Second Army, which was already withdrawing from Voronezh, and in three days they encircled two of its three corps. Hitler, who for a month had vacillated and discussed counterattacks to relieve Stalingrad, finally had to draw some conclusions. On January 27, he transferred the First Panzer Army to Army Group Don. Since this army was all that could still be removed through Rostov, the rest of Army Group A had to begin withdrawing into a large beachhead on the Taman Peninsula. This maneuver immobilized 400,000 men at a time when the entire southern flank of the eastern front was being shattered.

On January 31, Paulus, refusing to take the hint implicit in his promotion to the rank of field marshal the day before (no German field marshal had even been made prisoner), surrendered the troops that he still controlled in Stalingrad. A pocket around a tractor works in the northern suburbs of the city held out until February 2. On February 6, unwilling to risk another encirclement, Hitler gave Manstein permission to withdraw Army Group Don to the line of the Mius and Donets rivers, from which Army Group A had moved forward in July 1942.

In nine days, Army Group Don executed the retreat to the Mius. Meanwhile, the First Panzer Army moved to the army group's left flank on

the Donets. But the Soviet offensive was still moving forward at full speed. The right flank of Army Group B was forced back to Kharkov, which it lost on February 14-16. A 100-mile gap opened between the flanks of Army Groups B and Don, through which Soviet units struck southward and westward across the Donets. Six Soviet tank corps forming the Popov Group, named for its commander, Col. Gen. Markian M. Popov, moved forward to sever Army Group Don's communications lines. On February 13, it cut the Dnepropetrovsk-Stalino (now Donetsk) railroad, and by February 19 it had reached the Sinelnikovo railroad junction 20 miles east-southeast of Dnepropetrovsk and had begun to turn southward toward Zaporozhe.

On February 12, Hitler had removed the headquarters of Army Group B and divided its front between Army Groups Center and Don, simultaneously redesignating the latter Army Group South. At the same time he ordered 7 divisions transferred from France and Belgium to Army Group South. A week later he ordered Army Group A to begin evacuating troops by air from the Taman Peninsula to reinforce Army Group South; 100,000 troops were transferred by the end of the first week in March.

On February 18, without waiting for the arrival of the divisions from the west or the troops from Army Group A, Manstein initiated a series of maneuvers that were to produce the last German victory of the war. He ordered the headquarters of the Fourth Panzer Army to move to Dnepropetrovsk at about the center of the gap

between the First Panzer Army and the southern flank of the former Army Group B. There, with at first 4 divisions, he began creating a new Fourth Panzer Army. In eight days after February 20, the Fourth and First Panzer armies joined their flanks, trapping the Popov Group between them, and the Fourth Panzer Army closed up on its left to the front west of Kharkov.

At the end of the month warm weather set in, and the question then was whether to continue the advance toward Kharkov at the risk of its being halted by the approaching thaw. On March 7, the weather turned cold, and Manstein decided to proceed. The Fourth Panzer Army moved rapidly to the north, and despite knee-deep mud on all the roads reached Kharkov on March 11. Seven days later, after mopping up the Soviet divisions trapped west of Kharkov, the army carried its advance 30 miles farther north and took Belgorod. Except for several bridgeheads, in which Soviet troops held on doggedly, Army Group South had regained the line of the Donets to Belgorod. Immediately to the north the Russians held a large salient west of Kursk.

**Operation Citadel.**—For the past three years the coming of spring had heralded new German triumphs. The year 1943 was different. The victory on the Donets that ended the long winter retreat had restored German morale at the front, but not even Hitler deluded himself into believing that the next summer would see the swastika flag replanted on Mount Elbrus or German outposts again looking eastward into Asia from the high bank of the Volga. In the late spring there was an ominous quiet on the eastern front.

Since June 1941, German attention had centered in the east. In the early months of 1943, quite suddenly that, too, changed. Dangers which might have been overcome easily, had the Russian campaign developed according to schedule, threatened on all sides. In January 1943, United States Flying Fortresses staged the first daylight bombing attack on Germany. Thereafter bomb damage, particularly in the Ruhr, mounted alarmingly. A second Stalingrad had been in preparation in North Africa since November 1942. When the British Eighth Army broke through the Mareth Line late in March 1943, it became inevitable. That the British and Americans would follow their victory with an invasion of Italy or the Balkans was certain, and the day of the major test, the landing on the Channel coast, might come within the year.

On the other hand, the failure of Hitler's fanatical resistance doctrine during the winter had produced a substantial bonus. The long retreat from the Don, Stalingrad, and the Caucasus, as well as a voluntary retrograde movement which Army Group Center executed in February and March to shorten its front, had created surplus strength on the eastern front approximately equivalent to two armies. The disastrous winter had also forced Hitler to recall to active duty his tank expert, Guderian, and to appoint him inspector general for armor. By spring Guderian, working with Albert Speer, the minister for armament and munitions, had the new Tiger and Panther tanks coming from production lines by the hundreds. If another offensive in the style of 1941 or 1942 was no longer possible, neither was Germany helpless.

The most profitable strategy seemed to be to consolidate the so-called Fortress Europe and to

exploit the Clausewitzian axiom that defense was the stronger form of warfare. Some of the generals proposed building an East Wall, a permanently fortified line across the USSR, but Hitler disapproved. He did, however, instruct Army Group North to plan an operation to take Leningrad and stabilize the northern flank by joining forces with the Finns. He also began reinforcing the Army of Norway to enable it to occupy Sweden if that country attempted to support Allied operations directed against northern Europe. Nevertheless, after nearly three months' hesitation, he decided that he needed one more big victory in Russia, a victory, as he put it, "that will shine like a beacon around the world." On June 12, he announced that he intended to execute Operation Citadel.

Citadel, a two-pronged attack to eliminate the Soviet salient west of Kursk, had been planned in March to be executed as soon as the ground dried and while the Russians were still off balance from their defeat at Kharkov. Bad weather and various mishaps, as well as Hitler's own uncertainty, had caused repeated postponements. By the time he decided to proceed, the German forces for Citadel were at peak strength, and so, as one of the generals pointed out, were the Russians.

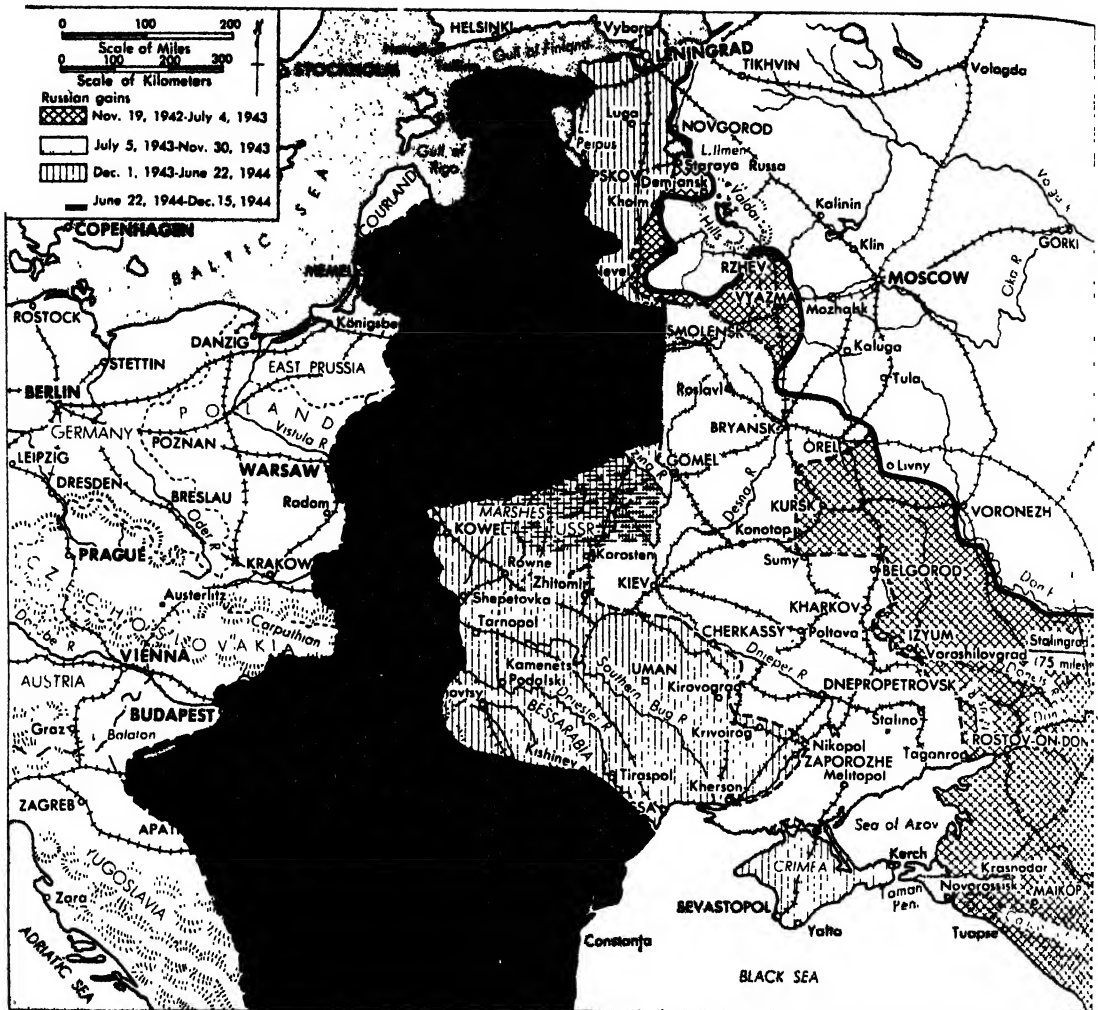
Operation Citadel began on July 5. The Ninth Army on the north and the Fourth Panzer Army on the south struck toward Kursk across the base of the Soviet salient. For three days the attack went well, but on July 9 the Ninth Army was stopped before a heavily fortified ridgeline and stayed there four days. On July 12, the Russians, confident that they had taken the measure of the Ninth Army's offensive, launched a strong attack of their own against the front north of Orel behind the Ninth Army. The Fourth Panzer Army was then just beginning to gather momentum.

On the next day, July 13, Hitler called the army group commanders to his headquarters and informed them that he had decided to halt Citadel. The situation north of Orel was precarious, and he was concerned about a Soviet threat to the Donets Basin; but his greatest source of worry was Sicily, where American and British troops had landed on July 10. The Italians, he said, were not fighting, and it was necessary to create new armies to defend Italy and the Balkans. Troops would have to be removed from the eastern front. Partly to gain troops for Italy, and partly because the offensive opened by the West Front, under Gen. (later Marshal) Vasili D. Sokolovski, and the Bryansk Front, under General Popov, had already gone too far, Hitler was forced to yield his own salient around Orel, ending the German threat to Kursk.

#### GERMAN WITHDRAWALS: 1943-1944

**Soviet Summer and Fall Offensives: August-November 1943.**—As the Russian campaign entered its third year, the world watched expectantly for the answers to two questions. Could the Germans recover from the effects of the winter battles for a second time and make another bid for victory? If not, could the Russians take the initiative without their old ally, "General Winter"? Citadel answered the first question, and the Soviet Army's subsequent performance erased the last lingering doubts inherent in the second.

After two years of war the Soviet Army was



**Map 23. OPERATIONS ON THE EASTERN FRONT (Nov. 19, 1942–Dec. 15, 1944).** The solid line on the map shows the front line on Nov. 19, 1942, the day the Russians counterattacked at Stalingrad. After the disaster the Germans withdrew rapidly in the south under heavy pressure. A successful German counterattack at Kharkov in March 1943 stemmed the Soviet advance. By July 4, Joseph Stalin's troops had overrun the area shown. A German attack the next day against the Kursk salient failed, and the Russians resumed the offensive. In a series of alternating attacks, which were costly to Adolf Hitler's strategic reserves, the advance overran the strong Dnieper River line by November 30. With scarcely a pause the offensive continued, now in the north as well as the south. By June 22, 1944, Leningrad and the Crimea had been freed, and Soviet troops were across the Rumanian border. Hitler's penchant for holding untenable positions made the German losses needlessly heavy. In the second half of 1944 the Russians struck several great blows concurrently with the Allied offensives in France and Italy. An attack through Minsk drove 250 miles in three weeks and destroyed two German armies. A blow in the north cleared Estonia, Lithuania, and most of Latvia; one in the south carried to the gates of Budapest, forcing Rumania and Bulgaria out of the war.

about to prove that it had completed its apprenticeship. It had developed tactics suited to large-scale offensive operations and had adapted them to its own limitations, which consisted primarily of a lack of initiative in the ranks and a frequent inability on the part of commanders and staffs below army levels to execute tactical maneuvers requiring precision or sensitivity to changing situations. The German blitzkrieg technique had delivered the decisive stroke with precision, speed, and economy of effort. The Russians, on the other hand, favored a broader lateral scope and more conservative execution. They adopted the breakthrough and penetration as basic tactical maneuvers, but they preferred to achieve the decisive effect by a series of relatively shallow

strokes along the breadth of the front rather than by one or several deep thrusts. Although the Russians claimed that Stalingrad had supplanted Cannae as the classic encirclement battle, they did not employ the double envelopment as frequently as the Germans had. More often they were content with a single thrust or with parallel thrusts, the objective being to force their opponent back on a broad front rather than to achieve a deep penetration along a single line of advance.

On the morning of Aug. 3, 1943, in the sector from which the Fourth Panzer Army had launched the southern arm of the attack toward Kursk, the massed artillery of the Soviet Sixth Guards Army laid down a barrage of several hours' duration on the German 167th Infantry



Division. When the artillery lifted its fire, 200 tanks roared into the German line, followed by waves of close-packed infantry. Before nightfall the German division was reduced to a few dazed survivors. Pouring through the gap, the Russians reached and took Belgorod on August 5. In another three days they had opened a 35-mile-wide gap on the right flank of the Fourth Panzer Army, giving them a clear road to the Dnieper River 100 miles to the southwest. On the same day, Manstein, the commanding general of Army Group South, informed Hitler that he lacked enough divisions to close the northern flank or to hold the long line on the Donets below Kharkov. He would either have to yield the Donets Basin or receive 20 divisions from somewhere else.

As he had on other occasions when confronted with unpleasant choices, Hitler avoided the decision by moving in an altogether different direction. He suddenly revived the idea of an East Wall, which he had rejected earlier. On August 12, he ordered construction started on a fortified line that was to begin in the south at Melitopol, run due north to the Dnieper River near Zaporozhe, follow the Dnieper to Kiev and the Desna to Chernigov, thence take a line almost due north to the southern tip of Lake Pskov, and, running along the west shores of Lakes Peipus and Pskov, anchor on the Gulf of Finland at Naiva. While it appeared that in ordering the East Wall Hitler had accepted a general retreat on the eastern front as inevitable, subsequent decisions revealed that he actually intended to establish a barrier behind which the armies could not retreat and, since no work of any kind had as yet been done on the so-called East Wall, give himself an excuse for holding out farther east.

In the last two weeks of August, the Soviet High Command expanded the offensive to the south and north. Kharkov fell on August 23. To the southeast the Russians broke through on the Donets south of Izyum and on the Mius River line east of Snigirevka. In the last week of the month they penetrated the Army Group Center front in three places. On August 31, Hitler gave the Sixth Army permission to retire from the Mius to the Kalmius River "if necessary." Three days later, he took a second positive step, ordering Army Group A to begin evacuating the useless beachhead which it still held on the Taman Peninsula.

The Sixth Army could not halt on the Kalmius. During the morning of September 6, a motorized mechanized corps and 9 Soviet rifle divisions broke through on the boundary between the Sixth and First Panzer armies. The next day a tank corps slipped through the gap, and, leaving the infantry behind, the two armored corps moved westward. By September 8, they were approaching Pavlograd, 30 miles east of the Dnieper and 100 miles behind the Sixth Army front. On that day, Hitler allowed the Sixth and First Panzer armies to start withdrawing to the line on which he had intended to build the East Wall, from Melitopol to the Dnieper north of Zaporozhe.

By September 14, the northern flank of Army Group South was disintegrating. The Fourth Panzer Army was split into three parts, and the Russians had a clear road open to Kiev. To the north, Army Group Center fared no better. The Second Army's front on the Desna, which was to have been part of the East Wall, was riddled with Soviet bridgeheads, and on September 14 the Russians began an offensive directed at Smolensk.

The next day, Hitler gave the two army groups permission to retreat to the line of the Dnieper, Sozh, and Pronya rivers. In most places the retreat was already under way, and in the last week of the month it developed into a race with the Russians for possession of the river lines. At the end of the month, as the last German troops crossed the rivers, the Russians had five bridgeheads on the Dnieper between the confluence of the Pripyat River and Dnepropetrovsk.

In two and one-half months, Army Groups South and Center had been forced back for an average of 150 miles on a front 650 miles long. The Germans had lost the most valuable territory they had taken in the Soviet Union. In an effort at least to deny the Russians the fruits of those economically rich areas, Hitler had instituted a scorched-earth policy, but in the end even that satisfaction was denied him. Nearly all of the factories, power plants, mines, and railroads could be destroyed, but the Germans lacked the personnel to transport or destroy more than a fraction of the agricultural and economic goods.

The Dnieper affords the strongest natural defense line in western European Russia, especially when the battle is moving from east to west. Fortified and adequately manned, the Dnieper line could have constituted an ideal defensive position, but Army Group South was so badly battered that the river provided at most a degree of natural protection and a tenuous handhold. Of the East Wall nothing was in existence; much of the proposed line had not even been surveyed.

On reaching the Dnieper, the Soviet Army had attained the original objectives of its summer offensive. Ordinarily the shortening of the German front, the defensive advantages of the river, the lengthening Russian lines of communications, and the attrition of the Russian forces could have been expected to bring the two sides into temporary balance. But Hitler had sacrificed too much of his strength east of the river. In contrast, the Russians' numerical superiority had enabled them to rest and refit their units in shifts, and they reached the Dnieper with their offensive capability largely intact. Before the last German troops crossed the river, the battle for the Dnieper line had begun.

In the first week of October, the whole eastern front was quiet as the Russians regrouped and brought up new forces. To underscore the victories achieved so far, they began renaming the front commands. Opposite Army Group South and the Sixth Army, which had passed to Army Group A, the Voronezh, Steppes, Southwest, and South fronts became the First, Second, Third, and Fourth Ukrainian fronts.

On October 9, the Fourth Ukrainian Front launched 45 rifle divisions, five tank and motorized mechanized corps, and two cavalry corps against the Sixth Army's 13 divisions in the line between Melitopol and the Dnieper. Within three weeks it drove the Sixth Army back across the flat, dusty Nogai Steppe to the lower Dnieper. Hitler refused last-minute requests to evacuate the Seventeenth Army from the Crimea, claiming that the Russians would thereby gain airfields from which to bomb the Rumanian oilfields. When the Sixth Army retreated beyond Perekop Isthmus, the Seventeenth Army was cut off, and in the first week of November Soviet troops gained beachheads on the Sivash Sea near the base of the isthmus and on the Kerch Peninsula.

While the Fourth Ukrainian Front was engaged below the Dnieper bend, the Second and

Third Ukrainian fronts operating against the First Panzer and Eighth armies carved a bridgehead 200 miles wide and 60 miles deep on the river between Cherkassy and Zaporozhe. On the south the Third Ukrainian Front threatened important iron and manganese mining areas near Krivoi Rog and Nikopol, which Hitler was determined to hold at any cost. The Russians had taken a large bridgehead at the confluence of the Pripyat and the Dnieper in September. South of it, on November 3, the First Ukrainian Front broke out of two smaller bridgeheads, and three days later it took Kiev. During the rest of the month it drove the Fourth Panzer Army back west and south of the city, threatening to demolish the entire left flank of Army Group South. To the north the Belorussian Front forced the right half of Army Group Center back from the Sozh River. Around Nevel, on the boundary between Army Groups Center and North, the First and Second Baltic fronts made a deep salient in the German front.

December brought some relief to the German armies, which for a few weeks regained their balance and even managed to counterattack west of Kiev. By this time the best solution for the German predicament would have been to withdraw Army Group South and the Sixth Army to the next major river, the Bug (Southern Bug), but Hitler would not consider it. He talked vaguely of retaking Kiev and of reopening the Crimean front. Actually, German prospects were worse than they had been in the two preceding winters. Opposing 3,000,000 German troops the Soviet Army had 5,700,000 men and an overwhelming superiority in tanks and artillery. In the summer and fall offensives the Russians had repeatedly laid down artillery barrages heavier than any since the great battles of World War I. Moreover, the German Army faced two new dangers: its manpower reserves were rapidly being exhausted, and an Anglo-American invasion in the west within the next half year was nearly certain. In November, Hitler notified the eastern front that it would have to manage on its own resources until the invasion had been defeated. The danger in the west, he said, was greater than that in Russia, and he could no longer take the responsibility for allowing the western front to be weakened for the benefit of other theaters of war. He suggested that possibly the eastern front might trade space for time, but events soon were to prove that he was constitutionally incapable of adopting this course.

**Offensives on the Outer Flanks.**—In the winter of 1943–1944 the weather, as always in Russia, became the third force in the fighting, but with a difference. The hard freeze which usually set in by mid-December and lasted into March did not arrive at all that winter in the south, and in the north it was frequently broken by thaws. Rain, sleet, slush, and mud tested the endurance of men and machines. Again the Russians had the advantage. They had sufficient reserves to give their troops occasional periods to rest and dry out. Their tanks, having wider tracks, performed better in mud than did the German armor. Their American-built lend-lease trucks ran through mud that hopelessly mired the two-wheel-drive German trucks. Both sides relied heavily on the light, high-riding one-horse *panje* wagon, the Russian peasant's answer to mud.

On Christmas Eve, the First Ukrainian Front drove two armies into the southern rim of the Fourth Panzer Army's front around Kiev, and the next day it developed a strong secondary thrust

to the west. Either of these thrusts could ultimately smash the entire southern flank of the eastern front. The thrust moving southward, if it reached the Black Sea coast, would envelop Army Groups South and A between the Dnieper and Dniester rivers. The thrust moving to the west, on reaching the Carpathian Mountains, could be employed to drive the two army groups back against the Black Sea and into the Balkans. Considering the first thrust the greater danger, Manstein ordered the Fourth Panzer Army to concentrate on stopping the Soviet armies going south, but even that task was temporarily beyond the army's strength. By mid-January, the First Tank Army, spearheading the First Ukrainian Front's southern thrust, had gained 65 miles and was approaching Uman.

On Jan. 10, 1944, the Third and Fourth Ukrainian fronts opened a two-pronged offensive against the Sixth Army. By the end of the month, mainly because Hitler rigidly insisted on holding the mines near Nikopol and Krivoi Rog, the Russians had nearly encircled the army's main force in the angle of the front east of Krivoi Rog. Not until February 19, after the army had lost nearly all of its vehicles and artillery, did Hitler give it permission to retreat to a line on the Ingulets and lower Dnieper rivers.

In the two years that had elapsed since the first Soviet winter offensive, Army Group North had by comparison with the rest of the eastern front been almost stationary. It had yielded some ground on the right, but it had kept its line firmly anchored on Lake Ilmen. Below the lake the old Russian towns of Staraya Russa and Kholm had lain directly on the front since the summer of 1941. Even the breakthrough at Nevel in October 1943 was more significant as a portent of a possible Soviet drive to outflank the army group in the south than for the immediate loss of ground it entailed. South of Lake Ladoga the army group had fought three battles to keep Leningrad under siege and had held the Russians to a token gain of a few miles along the lake shore. From the Volkhov River to the Gulf of Finland the front resembled a World War I battlefield. It was a complicated lacework of trenches and shell holes, the result of two and one-half years' fighting in which gains and losses on both sides could be measured in yards. By January 1944, however, the stable front no longer reflected the actual condition of the army group, which had lost its best divisions through transfers.

On January 15, the Leningrad Front launched two strong attacks, one south of the city and the other from the pocket around Oranienbaum (now Lomonosov) to the east. On the same day, the Volkhov Front struck at Novgorod north of Lake Ilmen. By the end of the fifth day of the battle, the German front was disintegrating in all three places, and on January 19 the Soviet troops completed the liberation of Leningrad. Thereafter the entire left flank of Army Group North cracked. Hitler, concerned about the effect that a more extensive retreat would have on Finland, which was already negotiating tentatively with the Soviet Union, at first ordered the army group to build a new front line on the Luga River. This attempt had no chance of success, and on February 13 he was forced to order the army group back into the Panther Line, the Narva River-Lake Peipus-Lake Pskov section of the ill-fated East Wall. The Panther Line was the only major part of the wall on which substantial work had been

lone, and when the army group reached it on March 1, it held.

During January and February, Army Group South fought in knee-deep mud, sleet storms, and blizzards to keep its front together. The First and Fourth Panzer armies managed to halt the Soviet southward thrust northeast of Uman, but by that time the First and Second Ukrainian fronts, with Zhukov commanding as at Stalingrad, had encircled two German corps northwest of Cherkassy. Army Group South concentrated almost its entire tank strength to rescue the corps, and on the night of February 17 approximately 30,000 men, about half the number originally in the pocket, broke out. In the meantime, the left flank of Army Group South had been driven behind the 1939 Polish border nearly to Kowel (now Kovel), Luck (now Lutsk), and Dubno. At the end of February, Army Groups South and A held a weak but (for the first time since Christmas) almost continuous line about halfway between the Dniester and the Bug.

**Western Ukraine and the Crimea: March-May 1944.**—After mid-February, it appeared to the German High Command that the army groups on the eastern front had seen another winter through. Army Group North was retiring to a fortified line. Army Groups South and A were less well provided for, but after the breakout from the pocket near Cherkassy the Russians were not on the march anywhere, and anyone who wanted to overlook the fact that the Soviet armies had continued to move through an abnormally warm, wet winter could assume that in a matter of days—in a few weeks at most, when spring set in—the front would sink into the mud for a month or so.

Field Marshal von Manstein was not so hopeful. He believed that the Russians would attempt at least to advance another 35 miles and cut the Lwów (now Lvov)-Odessa railroad behind Army Group South's left flank. The signs were plentiful that they could resume the offensive if they wished. During the fighting in January and February, the four Ukrainian fronts had at no time brought all of their strength to bear, and their reserves, instead of declining, had grown enormously. By mid-February, the Soviet High Command had shifted five of its six tank armies to the area opposite Army Group South. Three of them remained in reserve. At the end of the month the sixth tank army also appeared. The American-built trucks, the wide-tracked Soviet tanks, and the *panje* wagons had proved their ability to keep an offensive rolling through mud.

On March 4, the First, Second, and Third Ukrainian fronts attacked. The First Ukrainian Front, the strongest of the three, struck due south from the vicinity of Shepetovka into a gap between the First and Fourth Panzer armies' flanks. The Second Ukrainian Front hit the Eighth Army's center east of Uman, and the Third Ukrainian Front drove through the center of the Sixth Army below Krivoi Rog. The Soviet offensive advanced rapidly through the mud. Except on the left against the First Ukrainian Front, the Germans usually lacked sufficient troops even to place temporary roadblocks in the Russians' way. In quick succession the Soviet spearheads crossed three potential German defense lines, the Bug, Dniester, and Prut rivers. In the last week of March, the whole First Panzer Army was encircled at Kamenets-Podolski and had to break out to the west. After gaining 165 miles on the three main

thrust lines, the Soviet offensive halted in mid-April, leaving the Germans with a front which at its center was backed up against the Carpathians, and which they managed to hold only by utilizing, for the first time since Stalingrad, one Hungarian and two Rumanian armies.

At the height of the offensive, on March 30, Hitler had called the commanding generals of Army Groups South and A, Manstein and Kleist, to his headquarters and had dismissed them. On the eastern front, he had explained, the day of the master tacticians was past. What he needed were ruthless generals who would drive their troops to the utmost and extract the last ounce of capability for resistance. The two new-style generals whom he appointed were Field Marshal Walter Model to command Army Group South and Col. Gen. (later Field Marshal) Ferdinand Schörner to command Army Group A. A few days later, in a typical empty gesture, he redesignated Army Groups South and A as Army Groups North Ukraine and South Ukraine.

On April 8, almost as an afterthought, the Fourth Ukrainian Front launched an attack on the Crimea. The Seventeenth Army's front on Perekop Isthmus disintegrated in two days, and by April 16 the army was forced back to a small beachhead around Sevastopol. Until early May, Hitler had insisted on holding Sevastopol—to keep Turkey neutral, he said. By then the Russians had a clear field of observation across the whole beachhead to the tip of Cape Khersonesski. During four nights, German ships from Constanța, Rumania, attempted to evacuate the army, but only about half of the 65,000 men on the peninsula escaped. Meanwhile, on May 9, Sevastopol was reoccupied by the Russians.

#### SOVIET VICTORIES: 1944-1945

**Collapse in the Center: June-August 1944.**—In April and May 1944, it appeared, at least to Hitler and his closest advisers, that destiny might yet be made to bow to the führer's will. Everything depended on whether the invasion in the west, to which the United States and Great Britain had committed themselves at the Teheran Conference (Nov. 28-Dec. 1, 1943), could be defeated. A victory in the west would release the approximately 45 percent of its strength which Germany had retained there while awaiting the invasion.

Hitler's luck and his ability to win against heavy odds seemed not to have deserted him completely. Despite the disastrous winter, he had succeeded in maintaining his determination not to weaken the western defenses for the sake of the east. In March, he had been forced to send several panzer divisions to the east, but by the end of April he managed to form new divisions to replace them. Thereafter he was as nearly ready as he intended to be, and the Russians helped him indirectly by giving no sign that they intended to do anything to make their allies' landing easier. German industrial output was still rising. Synthetic oil production reached its peak in April, and the Luftwaffe had about 40 percent more planes than it had possessed a year earlier. The production of tanks and weapons was sufficient to equip new divisions for the west and to replace some of the losses in the east. All in all, it seemed that Germany could await the next roll of the dice with some confidence.

By mid-June, the dice had been rolled, and Germany had lost. Beginning in April and con-

tinuing through May and into June, the United States and British air forces staged bombing raids that eliminated 90 percent of the German synthetic oil production. On June 6, United States and British troops landed in Normandy, and in the next several days the strategy that Hitler had carefully nurtured since November 1943 collapsed. The powerful counterattack that he had envisioned did not materialize. Because he expected a second landing north of the Seine, he refused to take troops from the Fifteenth Army, which was closest to the Normandy beachhead, and decided instead to draw reinforcements from more remote areas. Consequently, the invaders were not driven from the beaches, and the German forces in Normandy were forced to the defensive.

In the east, Hitler and the Army General Staff expected the Russians to renew their pressure against the southern flank, attempting to smash Army Group North Ukraine against the Carpathians and drive Army Group South Ukraine into the Balkans. For the center they predicted a quiet summer. To meet the expected attack against Army Group North Ukraine, they transferred a panzer corps from Army Group Center and so deprived the latter of more than 80 percent of its tanks.

Army Group Center held the last major stretch of Soviet territory left in German hands: Belorussia eastward to the ancient gateway to Moscow between Vitebsk and Orsha 290 miles west of the Soviet capital. On June 22-23, the Russians attacked—not Army Group North Ukraine, as had been expected—but Army Group Center. Vasilevski was coordinating the First Baltic and Third Belorussian fronts at Vitebsk and Orsha, while Zhukov coordinated the Second and First Belorussian fronts opposite Mogilev and Bobruisk. In three days the Russians had made deep penetrations along the entire front. Hitler, who was determined not to yield any more ground in the Soviet Union, refused to allow segments of the front still standing to retreat. The Third Panzer Army on the north lost contact with Army Group North and began to drift with the Russian tide. In the center the flanks of the Fourth and Ninth armies were broken through. By the end of the month, the First Belorussian Front had trapped and was destroying two thirds of the Ninth Army around Bobruisk. Only the headquarters and one corps escaped. The commanding general of the Fourth Army had taken matters into his own hands and ordered his troops to retreat, but the army had to make its way through roadless forests and cross the Dnieper, Drut, and Berezina rivers. The Russians on its flanks were moving faster, and on July 3 they closed the army's last escape route at Minsk. In less than two weeks, Army Group Center had lost 25 of its 38 divisions.

On June 28, Hitler had combined the command of Army Groups Center and North Ukraine under Field Marshal Model. He intended by this step to facilitate the transfer of divisions from Army Group North Ukraine to Army Group Center, but by that time the former was itself threatened and could not spare many troops. To gain troops the generals favored withdrawing the northward-jutting front of Army Group North from the Narva-Lake Peipus line to a short line between Daugavpils (Dvinsk) and Riga, but Hitler would not agree. He was concerned about the effect on Finland and the danger to the navy's submarine training ground in the Baltic Sea. All Model could do was to commit what reinforce-

ments arrived, maneuver to gain the semblance of a coherent front, and wait for the Russians to lose their momentum.

In July, the Soviet offensive spread to the flanks. On the north the First Baltic Front drove into the gap between Army Groups Center and North toward East Prussia and the Baltic. On its right the Second and Third Baltic fronts forced Army Group North back to the Pskov-Daugavpils line. On July 29, a spearhead of the First Baltic Front reached the Baltic west of Riga and cut off Army Group North.

On the southern flank of Army Group Center the First Belorussian Front, powerfully assisted by an offensive which the First Ukrainian Front began against Army Group North Ukraine on July 13, developed a two-pronged thrust toward Brest (Brest-Litovsk). Late in the month, the First Belorussian Front carried its advance past Brest to Lublin and then turned northwestward toward Warsaw (Warszawa). The Russian point reached nearly to the Warsaw suburb of Praga on July 31. On the next day an uprising led by Tadeusz Komorowski (General Bor) broke out in Warsaw. East of the city, however, the Germans encircled and destroyed the leading Soviet tank corps, and thereafter the Russians left the Warsaw insurgents to their fate. While the First Belorussian Front devoted its attention to consolidating two bridgeheads south of Warsaw, the SS moved into the city, where after two months of savage fighting General Bor surrendered on October 2.

In August, the Soviet offensive subsided. Advancing as much as 350 miles in a little more than a month, the fronts had outrun their supplies. Army Groups Center and North Ukraine had been forced back to a line on the Vistula (Visla) and Narew (Narev) rivers and the East Prussian border, and the Russians held valuable bridgeheads across both rivers.

Beginning on August 16, Army Group Center launched a small counteroffensive that opened a narrow land corridor south of Riga to Army Group North. The respite was brief. On September 14, the three Baltic fronts began attacking toward Riga. When the Leningrad Front joined the offensive and on September 17 broke through at Tartu, Army Group North had to retreat to avoid being cut to pieces. At the end of the month the army group barely succeeded in escaping through the corridor south of Riga. On October 1, the First Baltic Front attacked due westward to the Baltic coast, which it reached near Memel (Klaipėda) on October 10. With that, Army Group North was cut off once more and had to withdraw into Courland (Kurland) west of Riga. It might still have broken out to the south, but Hitler insisted that it stay in Courland. He intended, he said, to open an offensive from there soon.

**Operations on the Southern Flank.**—Although its front had been quiet, Army Group South Ukraine was badly weakened by mid-August 1944. It had lost 5 of its 6 armored divisions and 4 infantry divisions through transfers. The Rumanians, both troops and civilians, were thinking increasingly of peace. On the morning of August 20, the Russians attacked. The Second Ukrainian Front struck southward past Iasi, and the Third Ukrainian Front pushed westward from two bridgeheads on the Dniester near Tiraspol. On August 25, they trapped the inner flanks of the Sixth and Eighth armies in an encirclement near Kishinev. On the same day, Rumania, having announced its acceptance of Allied armistice terms

On August 23 (the armistice was signed on September 12), declared war on Germany. The front dissolved into chaos. Some elements of the Eighth Army escaped into the Carpathians, while survivors of the Sixth Army fought their way southward between the mountains and the lower Danube River. On August 30, the Second Ukrainian Front captured the Ploesti oilfields, and the next day it entered Bucharest (Bucuresti). The Third Ukrainian Front occupied the Dobruja, and on September 8 crossed into Bulgaria, which requested an armistice (granted September 9) and declared war on Germany.

The thrusts into Rumania and Bulgaria automatically brought about the collapse of the German southeastern theater: the 300,000 Wehrmacht troops, organized into Army Groups E and F, who were defending the Adriatic and Aegean coasts and fighting partisans in Yugoslavia and Greece. Army Group E in Greece and Albania, after airlifting its troops from Crete and the other Greek islands, was forced to undertake a long and precarious march through the mountains of western Yugoslavia, which it did not complete until mid-November. Meanwhile, in September, the headquarters of the Eighth Army and the Sixth Army, using what troops they still retained, established fronts in the eastern Carpathians and the Transylvanian Alps. Farther to the west the Hungarian Second and Third armies formed a line on the border. In the second half of the month the Second and Third Ukrainian fronts regrouped and began turning northward for an offensive into Hungary and northeastern Yugoslavia.

The Third Ukrainian Front began operations on September 28 with an attack from Bulgaria toward Belgrade (Beograd). Three days later, the Second and Fourth Ukrainian fronts, coordinated by Marshal Timoshenko, began driving across the mountains in eastern Hungary. Belgrade fell on October 20. On the same day, the Second Ukrainian Front took Debrecen, and the Germans evacuated Transylvania to escape encirclement. By the end of the month the Second Ukrainian Front was across the Tisza (Tisa) River, and the Third Ukrainian Front had turned northward from Belgrade along the east bank of the Danube, which it began crossing near Apatin. In November, both fronts launched attacks toward Budapest against stiff German resistance. (Troops from Army Groups E and F had reinforced the Sixth and Eighth armies.) The first Soviet troops reached the outer Budapest defense ring on November 8, but Soviet progress was slow for the next six weeks. Finally a thrust by both fronts, begun on December 20, completed the encirclement of Budapest on December 27. Two days later, a Soviet-sponsored provisional Hungarian government declared war on Germany.

**Operations on the Northern Flank.**—Finland had gained its territorial objectives by November 1941, and after December of that year it had watched the war on the German front in the south with growing apprehension. The country was fortunate in that both Britain and the United States saw a certain amount of justice in its cause against the Soviet Union. At the Teheran Conference, President Franklin D. Roosevelt and Prime Minister Winston Churchill had persuaded Stalin to offer the Finns a negotiated peace on terms that would leave the country independent, but after a first appraisal of the Soviet terms the Finnish government, in March 1944, had found

them too onerous and rejected them.

On June 9, the Russians opened an offensive on the Karelian Isthmus, and in a month they had driven the Finnish Army back nearly to the 1940 border. The Finns were fortunate again in that a somewhat less than masterful Soviet performance, their own quick recovery after initial defeats, and German aid enabled them to keep the Russians from breaking into the heart of the country. On September 2, Finland appealed for an armistice, and on September 19 it signed the Soviet peace terms, which were oppressive but did not include a military occupation.

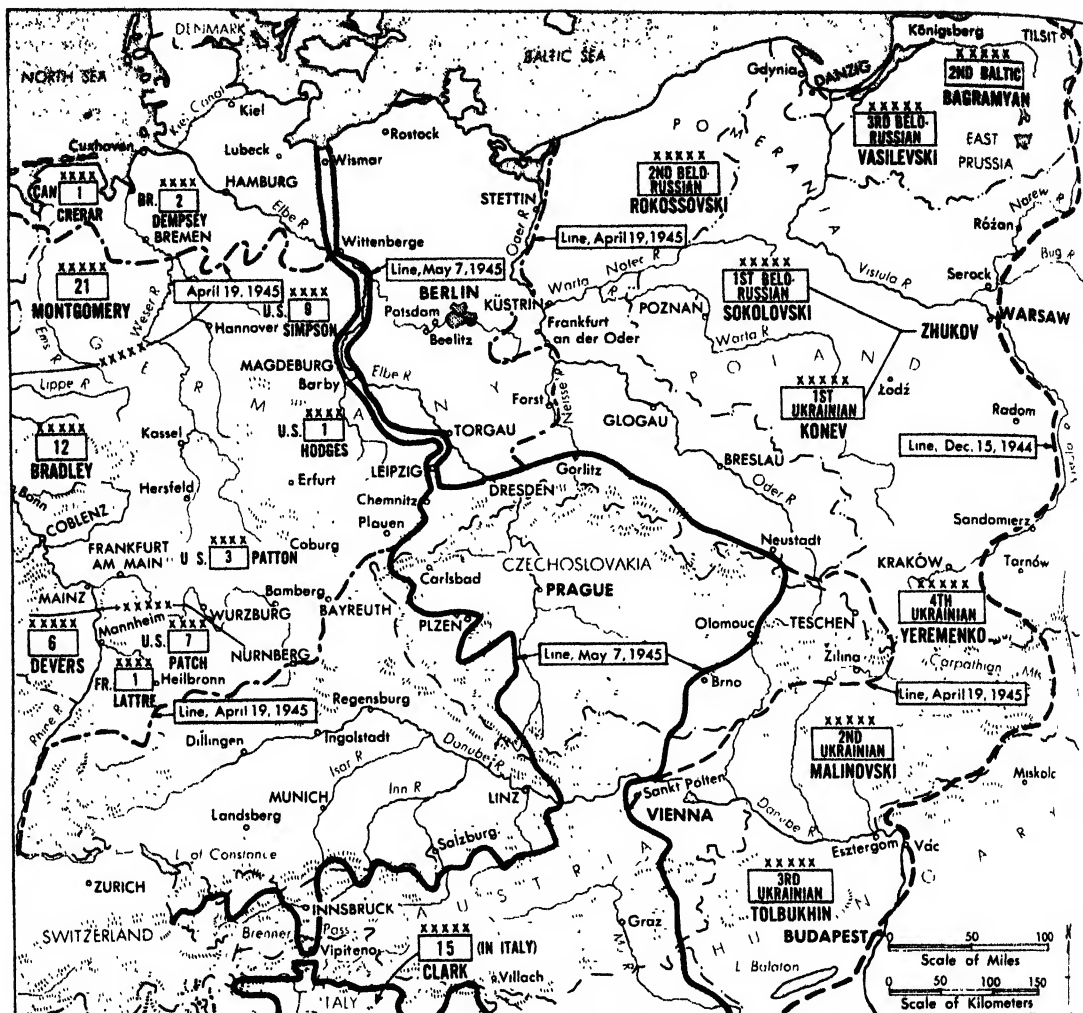
When the armistice went into effect, the German Twentieth Mountain Army still occupied Finnish Lapland north to the Arctic coast. After failing in 1941 to take Murmansk or to cut the Murmansk Railroad, it had settled down to positional warfare along the Soviet-Finnish border. Finland's removal from the war threatened to leave the army's southern flank dangling in a void. At first, Hitler wanted to swing the flank westward and hold northern Finland for the sake of the nickel mines near Petsamo, but later he decided to withdraw the entire army into the northern tip of Norway and then southward along the German-built coastal road. On September 6, the 200,000-man Twentieth Mountain Army began a four month's march across 500 miles of Arctic wilderness. In accordance with the Soviet armistice terms, the Finns attempted to disarm the Germans, but after several clashes in the south they did not interfere with the retreat (Finland formally declared war on Germany on March 3, 1945). The Russians, after failing to destroy the German corps stationed at Petsamo, halted their pursuit west of Kirkenes, Norway.

#### Advance into the Reich: January–April, 1945.

—At the turn of the year 1944–1945 the eastern front, bisected by the mountains of eastern Czechoslovakia, stood in the north approximately on the line reached in August 1944. In the south it followed the Czechoslovakian border to the west of Budapest and then veered southward along the line of Lake Balaton and the Drava and Danube rivers. In the north the Russians had bridgeheads across the Narew and Vistula rivers at Rózan, Serock, and Sandomierz. In the south they had encircled Budapest and had nearly reached the last German-held oilfield at Nagykanizsa. The routes to Berlin and the Silesian industrial region lay open across the Polish plain, but Hitler hoped that he could recover some of his prestige by a victory in the south. After Christmas he had transferred the 4th SS Panzer Corps from the Warsaw front to the front near Budapest.

Between January 12 and January 14, the First, Second, and Third Belorussian fronts and the First Ukrainian Front attacked. Exploiting the bridgeheads, each front achieved a complete breakthrough on the first or second day. The Second and Third Belorussian fronts went northwestward and westward against East Prussia from the line north of Warsaw. By January 26, they had driven a spearhead through to the Baltic coast east of Danzig (Gdańsk), and they then began cutting up the two German armies to the northeast. The First Belorussian and First Ukrainian fronts moved westward from the front between Warsaw and the Sandomierz bridgehead toward the Oder River. After the first four days the breakthrough was so thoroughly accomplished that the Soviet armies could move in columns along the roads at speeds averaging between 20 and 25 miles a day.





**Map 24. FINAL SOVIET OFFENSIVES (Jan. 12-May 7, 1945).** By mid-January 1945, the Russians had assembled reserves and supplies and were ready to resume the offensive. Springing from the line marked Dec. 15, 1944, the armies in the north pushed ahead rapidly. By early February 1945, they had reached the Oder River, but there they were held up for several weeks. In mid-April, after regrouping, they broke through the German defenses and struck for Berlin. In the south the offensive moved generally up the Danube Valley, captured Budapest and Vienna, and, in conjunction with Marshal Tito's Yugoslav partisans, cleared the Germans from most of the Balkans. The map shows the positions of the Allied forces in the west and in the east on April 19 and May 7, the date of the German surrender. The United States First and Ninth armies had reached the Elbe by April 19, but they halted at that river line in accordance with prior Allied agreements.

The First Belorussian Front bypassed Poznań on January 22, and by February 3 had drawn up to the Oder on a broad front 36 miles east of Berlin. A week earlier, the First Ukrainian Front had reached the middle Oder and established several bridgeheads. On February 8, it began attacking across the Oder north of Breslau (now Wrocław), and by early March had cleared Silesia and had then halted on the Neisse (Lusatian Neisse) River line.

On the northern flank of the First Belorussian Front the newly created German Army Group Vistula still held a long front between the lower Oder and lower Vistula in early February. In the middle of the month the Germans attacked from that front into the rear of the Russians on the Oder opposite Berlin. The attack failed, and on February 24 the First Belorussian Front turned to the north. By March 10, it had thrown one German army back against the Baltic coast near Danzig,

had driven through Pomerania (Pomorze) to the sea, and had cleared the right bank of the Oder to its mouth.

On the front in Hungary the Germans staged three attempts during January to relieve Budapest. The third, which began on January 18, penetrated deeply into the Soviet front but did not reach the city. On January 27, the Third Ukrainian Front counterattacked, and Budapest fell on February 13. In mid-February, Hitler transferred the Sixth Panzer Army from the Ardennes to Hungary, where he illogically insisted on attempting to regain the Danube line. The offensive began on March 6 and continued for 10 days without significant gains. On March 16, the Second and Third Ukrainian fronts struck back and in a little more than a week broke through on both sides of Lake Balaton. On March 30, the Russians crossed the border into Austria, and on April 13 they took Vienna.

**Last Soviet Offensive.**—By April 1, 1945, Germany had been defeated. Silesia was gone, and the Ruhr was encircled. The output of tanks, artillery, and ammunition in the first quarter of 1945 was only about half the monthly average for 1944. From January through March, the Luftwaffe received between a twelfth and a twentieth of its requirements in aviation gasoline. The eastern and western fronts stood back to back with no room in which to maneuver. The war continued because Hitler was still in command, and he hoped for another "miracle of the house of Brandenburg," a collapse of the enemy coalition like that in the Seven Years' War which had rescued Frederick the Great from similarly desperate straits.

On the Oder-Neisse line the Russians in April regrouped the Second Belorussian Front in the north under Marshal Konstantin K. Rokossovski, the First Belorussian Front in the center opposite Berlin under Marshal Zhukov, and the First Ukrainian Front in the south under Marshal Konev. The First Belorussian and First Ukrainian fronts opened the offensive on April 16. Konev's armies achieved a complete breakthrough on the first day. The First Belorussian Front, heading straight toward Berlin from a bridgehead at Küstrin (now Kostrzyn) on the Oder River, was not so fortunate. It required two days to break out of the bridgehead and then was stopped again on April 21 at the outskirts of Berlin. In the meantime, the First Ukrainian Front had turned two tank armies to the northwest. By nightfall on April 24 they and elements of the First Belorussian Front coming from the north had closed a ring around the city. The next day, the Soviet Fifth Guards Army made contact with the United States First Army at Torgau on the Elbe River south of Berlin, and Germany was split into two parts.

Hitler had decided to remain in Berlin to the end. From his elaborate air-raid shelter he attempted to maneuver armies as he had in the old days. His first order, following the standard pattern which had failed so often in the past three years, was to hold the line and close the gaps. It was impossible to execute. On April 20, the Second Belorussian Front forced the Third Panzer army from the Oder. By that time the Ninth army was trapped between the flanks of the First Ukrainian and First Belorussian fronts. On April 24, Hitler ordered the Ninth Army to strike toward Berlin from the south and the Twelfth Army, facing American forces on the Elbe, to turn around and drive into the city from the west. The Twelfth Army managed to make the turn and reached Beelitz, 18 miles southwest of Berlin; here it was halted. On April 30, Hitler committed suicide, and two days later resistance ended in Berlin.

In the last week of the war the German armies on the eastern front all had one objective: to escape capture by the Russians. North and west of Berlin the Third Panzer, Twenty-first, and Twelfth armies succeeded in making agreements with United States Army commands which allowed them to pass through American lines. Army Group Center's Fourth Panzer, Seventeenth, and First Panzer armies were farther east on the upper Elbe River and in Czechoslovakia. After the unconditional surrender in Reims on May 7 (a second surrender ceremony was held in Berlin on May 9), they attempted a mass escape to the west but were stopped forward of the American-Soviet demarcation line, and nearly all of them, or about 1,000,000 men, passed into Soviet captivity. Some

troops of Army Groups South, E, and Courland escaped in the last days, but most fell prisoner to the Russians. All told, the Russians took about 2,000,000 prisoners in the days immediately preceding and following the surrender.

In sheer material and human destructiveness the Russian campaign had no equal in World War II. The total German dead, either as battle casualties or as prisoners of war, probably numbered about 3,500,000. Soviet losses were at least twice as great and may have gone much higher without even beginning to include deaths among the civilian population resulting from German or Soviet action. That Germany lost the campaign can be attributed primarily to its being forced into a conflict of mass against mass which far outran its industrial and human resources. Unable from the first to compete with the Russians in expending human life, the Germans were eventually crushed by the weight of Soviet arms. After 1941, Soviet war matériel production quickly overtook and surpassed that of Germany. Additionally, the USSR received lend-lease aid, mostly from the United States, valued at over \$11 billion. Among the more significant items were 409,526 trucks, 12,161 tanks and self-propelled guns, 14,000 airplanes, and 325,784 tons of explosives. Furthermore, the Soviet Union was able to commit more than 90 percent of its military strength against Germany, while the Germans were forced to retain a large part of theirs (35 to 45 percent in the years 1943 and 1944) in other theaters.

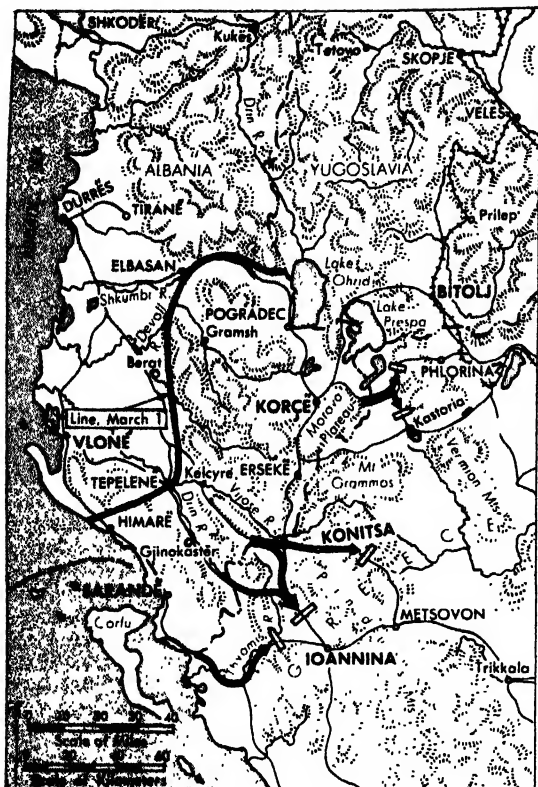
See also sections 13, *Developments in Air Warfare* and 14, *Diplomatic History*; separate biographies of the various political and military figures; GERMANY—4, *History Since 1850* (Hitler's Third Reich, 1939–1945); UNION OF SOVIET SOCIALIST REPUBLICS—16, *History of Russia and the USSR* (World War II and the Postwar Period); and historical sections of articles on other countries involved in the campaigns on the eastern front.

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## 7. Balkan Campaigns

During nearly the entire first year of World War II, Hitler's primary concern with southeastern Europe was to avoid trouble in the area. By the late summer of 1940, however, his attitude had begun to change. The Soviet Union had annexed Bessarabia and northern Bucovina in June, and it clearly intended to reach farther south and west at the first good opportunity. Hitler, on the other hand, had started to think in terms of a conflict with the USSR. In such an eventuality he would need security on his deep southern flank, and above all he would need Rumanian oil. He would still have preferred to establish German hegemony in the Balkans without fighting, and he would probably have succeeded in doing so had Benito Mussolini not made his bungling attempt to invade Greece from Italian-occupied Albania on October 28.

The Italian attack was planned as a police action in the style of the German triumphal march into Czechoslovakia. Its general purpose was to show the world that Mussolini was not always dependent on Hitler: specifically, it was intended to match the action of the Germans, who three weeks earlier had unilaterally stationed troops in Rumania, then under a joint German-Italian guarantee. Hitler, who had been irritated by his Axis



**Map 25. ITALO-GREEK WAR (Oct. 28, 1940–March 1, 1941).** To emulate his mentor, Adolf Hitler, Benito Mussolini planned a triumphal entry into Greece, such as the führer had made into Czechoslovakia. His troops advanced across the Albanian border on Oct. 28, 1940, in four columns (heavy black arrows). But the Greeks were not passive; their resistance stiffened, and by November 8 the Italian advance had been halted at the points shown. Then, with the aid of British air contingents that had arrived in Greece on November 3, the Greeks counterattacked. Relentlessly they pushed forward; by mid-December, the Italians had been driven 50 miles behind the border. Mussolini sent heavy reinforcements to Albania and counterattacked several times, but to no avail. By March 1, the line had been stabilized as shown. Hitler's imminent invasion of Yugoslavia and northern Greece was to relieve the Italian dictator of further embarrassment.

partner's unexpected move, became furious when the collapse of the Italian offensive close to the Albanian-Greek border opened the way for the development he wanted least of all, British intervention in Greece. The British occupied Crete and Lemnos (Limnos) on October 31, and in the next few days they established air units in southern Greece within bombing range of the Rumanian Ploesti oilfields. On November 4, Hitler ordered the German Army High Command to begin preparing for an attack on Greece.

Faced with a delay of four or five months until good campaigning weather returned, the Germans sought to open the approaches to the northern Greek border by political means. In November, Hungary and Rumania adhered to the Tripartite Pact of the Axis (concluded by Germany, Italy, and Japan in September). The Rumanian dictator, Gen. (later Marshal) Ion Antonescu, welcomed this insurance against the Soviet Union. Bulgaria, which was to provide the actual

staging area for the operation against Greece hesitated to commit itself in view of possible unfavorable Soviet and Turkish reactions. Hitler, knowing that Bulgaria as one of the defeated nations in World War I would find it difficult to refuse an opportunity to obtain revenge, was willing to move slowly. German army engineers began bridging the Danube River on Feb. 28, 1941 and on March 1, just before German troops crossed the Rumanian border into the country, Bulgarians signed the Tripartite Pact.

In the case of Yugoslavia, Hitler was prepared to accept limited adherence to the Axis, for all he required was the use of the Belgrade (Beograd) Niš-Salonika railroad. (Rail connections through Bulgaria were poor.) The Yugoslav government resisted his overtures, but in mid-March, after having refused several earlier invitations, it suddenly changed its policy and offered to sign the Tripartite Pact. The ceremony was held in Vienna on March 25. A day and a half later, on the night of March 26–27, a military coup d'état forced Prince Regent Paul into exile. Young King Peter II was declared of age, and Gen. Dušan Simović formed a new government. While it did not denounce the recent adherence to the Tripartite Pact, it refused to ratify Yugoslavia's signature.

On March 27, Hitler declared that he was determined "to destroy Yugoslavia as a military power and a sovereign state," and he ordered the Wehrmacht staffs to complete military preparations at the greatest possible speed. Turning to their traditional protectors, the Russians, the Yugoslavs sent a delegation to Moscow on April 3. They failed to obtain a mutual assistance pact however, and on April 5 were forced to accept instead a relatively meaningless treaty of friendship and nonaggression. The next day the German invasion began.

**Campaign in Yugoslavia.**—A rugged, mountainous terrain and wide-meshed, underdeveloped road and rail networks were Yugoslavia's strongest potential defensive assets. Although these assets were to be important during the years of guerrilla warfare, they did not serve to improve the country's very difficult strategic position in April 1941. To defend a land frontier of 1,700 miles the Yugoslav Army had a hypothetical maximum strength of 1,000,000. Even if it had been able to call up that many men, it could not have armed and equipped them. Since 1939 the army had been cut off from its principal supplier of weapons and ammunition, the Škoda works in Czechoslovakia. Nevertheless, the General Staff proposed to employ eight of its nine armies, which at full strength were approximately equivalent to German corps, in a linear defense of the entire frontier. In the first week of April, it rejected a Greek plan to sacrifice most of the country for the sake of securing a strong common front with the Greeks and the British in the south. Moreover, no matter what the staff intended, deep-seated differences between the Serbian and Croatian elements in the population threatened to divide both the army and the nation as soon as war broke out.

When Gen. (later Field Marshal) Sir John Greer Dill, the British chief of staff, visited Belgrade on April 1, he found the government confused and almost apathetic. It seemed above all to wish to avoid provoking the Germans in the forlorn hope that a conflict could still be avoided or at least postponed. In the end, the only cooperation arranged between the Yugoslav and Greek forces took the quixotic form of a projected

int offensive against the Italians in Albania.

For the Germans the operation against Yugoslavia, in full swing 10 days after it was first ordered, was mainly an exercise in staff virtuosity. The most difficult task was to shift the German Second Army, composed of nine divisions under Col. Gen. (later Field Marshal) Maximilian von Weichs, to the northern Yugoslav border. The divisions had to be moved by rail and truck from France, Germany, and the Soviet border. The other major attack force, consisting of the five divisions of the 1st Panzer Group under Col. Gen. (later Field Marshal) Ewald von Kleist, was diverted from the assembly for the attack on Greece.

The plan was for the Second Army to break through the Yugoslav lines on a broad front north and northeast of Zagreb and to advance southward between the Drava and Sava rivers toward Belgrade. The 1st Panzer Group was to cross the border northwest of Sofia (Sofiya), Bulgaria, take Niš, and thrust northward up the Morava Valley to Belgrade. A third force, the 41st Panzer Corps, taking the short route across the Rumanian border from the area south of Timișoara, was to converge on Belgrade from the northeast.

In the early morning hours of April 6, German planes bombed Belgrade. They came in at rooftop level, and in an hour and a half killed more than 17,000 of the city's inhabitants and almost completely destroyed the Yugoslav High Command's communications with its forces in the field. The 1st Panzer Group crossed the border at daylight on April 8. While it encountered the Yugoslav Fifth Army, one of the few fully mobilized Yugoslav units, rough terrain and roadblocks proved to be the chief obstacles to its advance. After taking Niš on April 9, it broke away rapidly to the north toward Belgrade. In the meantime, another German force cut across southern Yugoslavia to divide the country from Greece. The Yugoslavs had opened their Albanian offensive on April 7, and for three days they made steady progress against the Italians.

The German Second Army launched local attacks on April 6, but because some of its major elements were still on the way, it did not attack in full strength until April 10. On that day, the Croat troops in the Yugoslav Fourth and Seventh armies, stationed on the northern frontier, mutinied, and by nightfall both armies had been dissolved. On the afternoon of April 10, Second Army troops entered Zagreb, where a newly created Croat government welcomed them as liberators. During the day, conceding by implication that he had lost control of the situation, General Simović called on all Yugoslav units to engage the enemy "wherever they met him and by any means" without waiting for orders from higher headquarters.

German forces converged on Belgrade from three directions on April 12. In the early evening an SS lieutenant from the 41st Panzer Corps took a patrol into the capital, hoisted the swastika flag over the German legation, and accepted the mayor's offer to surrender the city. On the morning of the following day, Easter Sunday, German armored spearheads entered Belgrade. The chief of the German Army General Staff noted in his diary that the campaign was over: all that remained was the mopping up. The Second Army had three columns moving westward and southward toward Sarajevo to block any attempt to establish a front in the mountains, but it encountered only masses of troops waiting to sur-

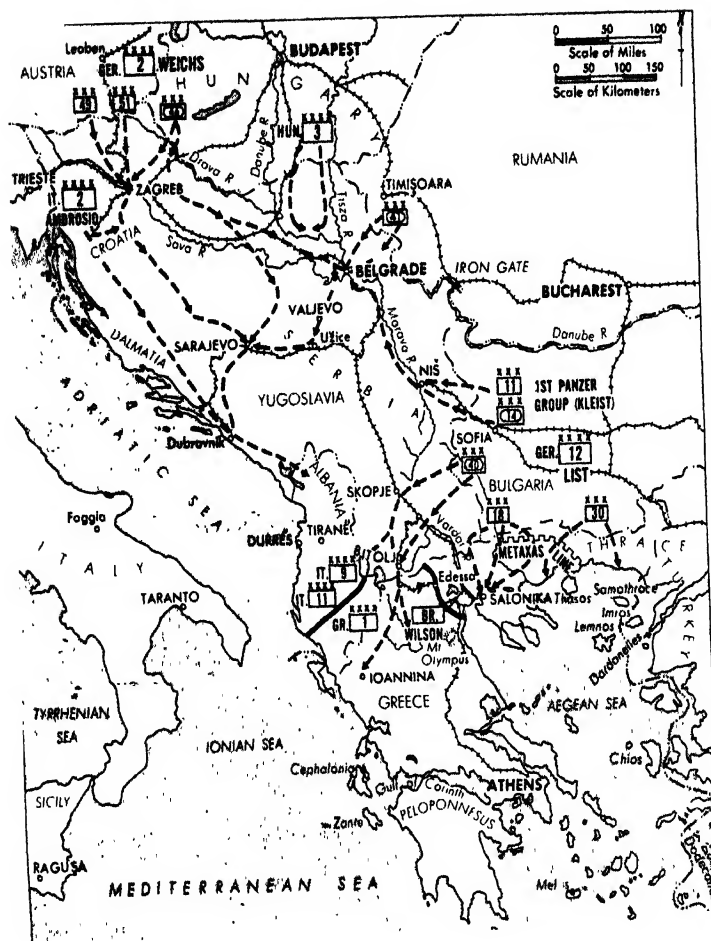
render. In some places fighting had broken out between Croat and Serb units.

On April 14, Gen. Danilo Katafotović took command of the Yugoslav forces and opened negotiations for an armistice, which was signed three days later. German casualties in the campaign totaled 558; those of the Yugoslavs ran much higher. The Germans took 344,000 prisoners. The Yugoslav Army had mobilized approximately 500,000 men, but many of them deserted before the fighting ended. Others, following the national tradition, slipped away to carry on guerrilla warfare. Chetnik (četnići) units had been organized before the invasion began, and later Partisan groups also were formed.

**Campaign in Greece.**—The Greek High Command was fully aware that Germany would not permit its ally, Italy, to be embroiled in an embarrassing little war indefinitely. In mid-February 1941, therefore, the Greeks seized their last chance and opened an offensive that was intended to drive the Italians from Albania before the Wehrmacht could intervene. The offensive made progress, but it was not sufficient. At the turn of the month, German troops marched into Bulgaria, and a British expeditionary force, which with earlier arrivals eventually numbered approximately 62,500 troops, began moving into Greece. Because of its fear of provoking the Germans, the Greek government had previously been reluctant to accept large-scale British assistance.

The Greek Army, commanded by Gen. (later Field Marshal) Alexander Papagos, had a total effective strength of 430,000 men. Unlike the Yugoslav Army, it was fully mobilized and to some extent battle tested. Its problem in countering a German attack was complicated by the psychological and political necessity of defending the long northern frontier. The army command believed that it could not voluntarily evacuate Albania, since to do so would seem to concede victory to the Italians. On the other hand, it was convinced that national morale would be equally damaged if it were to give up the long tongue of Greek territory extending east of Salonika. There the Metaxas Line covered the Bulgarian border. Built only for use in the event of a war with Bulgaria, the line could not withstand a German attack, but it had cost a great deal of money and in the popular mind had become a symbol of national security. The British commander, Lt. Gen. (later Field Marshal) Sir Henry Maitland Wilson (later 1st Baron Wilson of Libya and of Stowlangtoft) lacked sufficient troops to close the gap between the front in Albania and the Metaxas Line, and he therefore placed his forces in a short line facing northeastward along the Vermion Mountains and the lower Aliakmon River. Apparently, neither the Greeks nor the British had decided on a course of action if the Germans attacked across the virtually undefended Yugoslav border, and it was just there that one or two thrusts would outflank all three segments of the Greek-British front.

The German Twelfth Army, under Field Marshal Wilhelm List, executed the campaign in Greece. It had three corps headquarters commanding 12 divisions. In the assembly one corps was stationed southwest of Sofia, to attack toward Skopje (Skoplje) in southern Yugoslavia and then southward into Greece. The second was placed in the southwest corner of Bulgaria to attack through and around the flank of the Metaxas Line toward Salonika, and the third was moved close



**Map 26. FALL OF YUGOSLAVIA AND GREECE (April 6-30, 1941).** Yugoslavia's refusal to allow German troops and supplies destined for Turkey to pass over her railroads brought on a German invasion. Yugoslav forces were only partially mobilized, and were strung along an extensive frontier. The few trained and equipped units offered stiff resistance in their limited sectors, but the key cities were soon captured by the stronger German forces, and the Yugoslav troops were dispersed or captured.

Benito Mussolini's Greek venture had resulted in the entrance of British ground and air forces into Greece, in accordance with an Anglo-Greek mutual aid agreement. Adolf Hitler's last desire was to have British bombers within range of the Ploesti oil fields, his chief source of supply. He therefore decided to conquer Greece and expel the British. The advance through Yugoslavia had opened the way for his troops to attack the exposed flanks of the Greek and British positions, and the occupants were soon forced to withdraw. The Greeks were cut off and made to surrender; a large proportion of the British troops were evacuated to the island of Crete.

to the eastern end of the Greek-Bulgarian border. The heavy concentration against the narrow strip of territory east of Salonika resulted mainly from Hitler's desire to defeat at the outset any British attempt to retain a foothold in northern Greece or on the Aegean Islands, Thasos, Samothrace (Samothrake), and Lemnos.

The Twelfth Army attacked on April 6. The units moving toward Skopje encountered the fully mobilized Yugoslav Third Army and became involved in heavy fighting, as did those attacking the Metaxas Line frontally, but everywhere the offensive made good progress. On April 9, Salonika fell, and the Greek Second Army surrendered, thereby ending resistance on the Metaxas Line and in all the territory east of Salonika.

The German corps advancing through southern Yugoslavia took Skopje on April 7, and began turning south. On April 10, it attacked through the Bitolj (Monastir) gap between the open flanks of the British line along the Vermion Mountains, and the Greek front in Albania. The British immediately began retreating toward Mount Olympus (Olymbos), and the next day the Greek First Army decided to withdraw southward from Albania. When the Germans took Metsovon Pass on April 21, the First Army's route of escape from the area around and north of Ioannina was cut. The army surrendered the next day. The British force retreated southward along the Aegean coast

toward Athens (Athenai). The Germans took the city and reached the Isthmus of Corinth on April 27, and in three more days occupied the Peloponnesus (Peloponnesos). Most of the 12,000 British casualties were incurred during these last days, when the German ground forces closed in, and the ships evacuating the troops were forced to come toward shore without air cover. The Germans lost 1,100 men killed and 4,000 missing and wounded.

Greece was liberated by British troops from the Mediterranean theater in late 1944 (see section 8. *Mediterranean Operations*), and Yugoslavia was cleared of German troops during the Russian final offensive in 1945 (see section 6. *German Invasion of the USSR*). See also separate biographies of the leading military and political figures; BULGARIA—10. *History* (Developments Since 1941); GREECE—7. *Modern History* (Greece in World War II, 1940-1945); RUMANIA—History (Rumania in World War II, 1940-1944); YUGOSLAVIA—History (World War II).

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## 8. Mediterranean Operations

This section covers not only operations in the Mediterranean theater itself, but also the British campaign against the Italians in East Africa and



military activities in Iraq and Iran, which are inseparable from operations in the Mediterranean proper. Since naval and air warfare are considered separately (see sections 12. *Developments in Naval Warfare* and 13. *Developments in Air Warfare*), the emphasis is on the land campaigns in Egypt, Libya, East Africa, French North Africa, Crete, Syria, Italy (including Sicily), and numerous Mediterranean islands.

The Mediterranean theater varied in importance as World War II progressed. Before the entry of Italy in June 1940 it was inactive; from that time onward, until the German attack on the USSR in June 1941, it was the main operational area and the only one where there was fighting on land. With the Anglo-American landings in French North Africa in November 1942 (Operation Torch) until August 1943, when plans for the invasion of northwestern Europe (Operation Overlord) were approved by the Combined Chiefs of Staff, it assumed increasing significance, but when Overlord was mounted in June 1944, the Mediterranean became a secondary theater.

**Background to Conflict: 1933-1939.**—The six and one-half years after Adolf Hitler became chancellor of the German Reich in January 1933 were a period of mounting tension in the Mediterranean and nearby areas as in other regions. In October 1935, Italy, correctly judging the impotence of the League of Nations, decided to extend her already considerable empire in Africa by invading Ethiopia, and by May 1936 she had completed the annexation of the country.

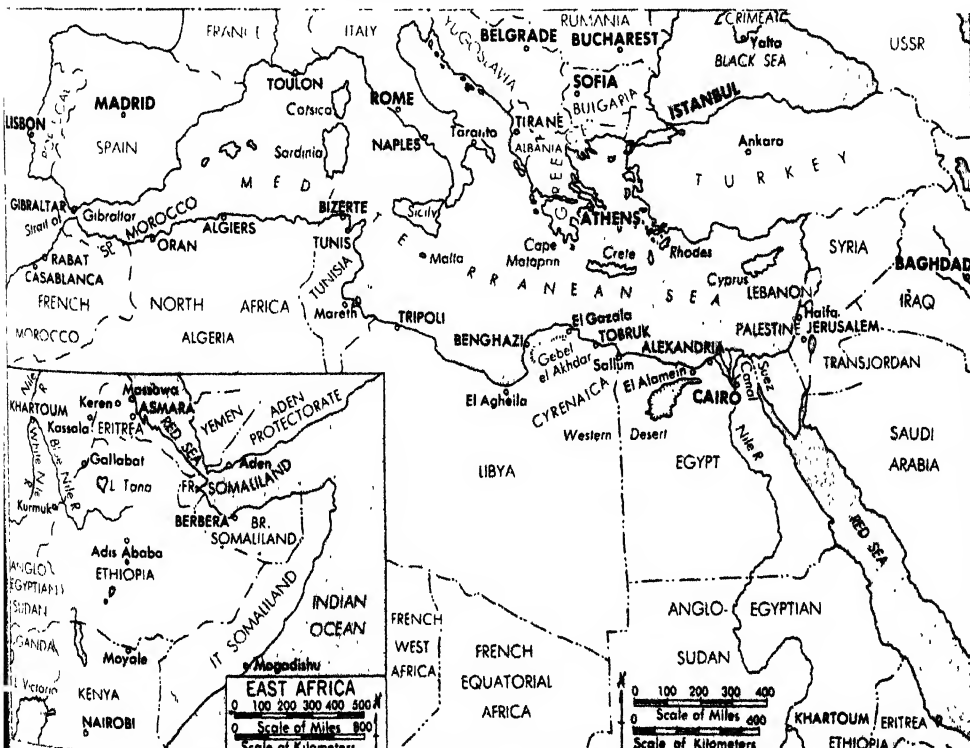
Later that year, on August 26, Anglo-Egyptian relations were put on a more satisfactory basis by the conclusion of a treaty, the effect of which was that in war Egypt would be Britain's

ally. The Suez Canal was to be safeguarded by the continued presence of a British force, but to assuage Egyptian susceptibilities the troops were to be confined to a narrow zone along the canal itself. The British were also to enjoy certain harbor and dock facilities and the use of railway and road communications.

The somewhat loose alliance between Germany and Italy subsequently known as the Rome-Berlin Axis was concluded on October 25. On Jan. 2, 1937, British and Italian relations were eased by the signing of a joint declaration (known ironically as the Gentlemen's Agreement), the main clause of which recognized freedom of movement for both parties in the Mediterranean. The declaration was reaffirmed in April 1938, when the two governments also agreed to exchange information annually concerning any major changes or proposed changes in the strength and dispositions of their respective armed forces. Just at this time, Britain's position in the Middle East was complicated by unrest in its mandate of Palestine, where open rebellion had broken out. A year later, on April 7, 1939, Italy invaded Albania, and within a short time occupied the whole country.

Meanwhile, Hitler's various acts of aggression, culminating in the invasion of Czechoslovakia in March 1939, and his threatening attitude toward Poland were bringing Europe to the brink of general war. Under an agreement announced on August 25, Britain guaranteed that it would go to the assistance of Poland in the event of German aggression. Germany invaded Poland on September 1, and two days later, Britain and France declared war on Germany. By September 10, the other members of the British Common-

Map 27. MEDITERRANEAN THEATER OF OPERATIONS.



wealth of Nations had made similar declarations. See also section 2. *Between World Wars*.

#### CAMPAIGNS IN AFRICA

French and British staff conversations, which began in London at the end of March 1939, included the broad outline of plans for conducting joint operations in the Mediterranean. Later, in May and June, meetings between British and French commanders in the Mediterranean and the Middle East were held at Rabat, Aden, and Jerusalem.

With the outbreak of war between Germany and the Allies on Sept. 3, 1939, Italy found herself in a difficult position. She had an extensive African empire, consisting of the older colonies of Eritrea, Italian Somaliland, and Libya and the more recently acquired Ethiopia. Even if her Axis partner gained early successes in northern Europe, Italy's communications with her African possessions would be cut except for the occasional ship or aircraft which might make a hazardous journey. The British and French navies dominated the Mediterranean with powerful fleets based on British naval bases at Gibraltar, Malta, and Alexandria and on French bases at Toulon, Bizerte, Algiers, and Oran. In Libya the Italian garrison was sandwiched between strong French forces in French North Africa and considerable British forces in Egypt; and Italy's other colonies were surrounded by potential enemies on all sides, although the forces arrayed against her were not very formidable in the early stages of the war. Under these conditions the Italian dictator, Benito Mussolini, adopted the only practical course of remaining nominally neutral while giving all possible support to Germany.

With Italy neutral and Germany without access to the area (except for an occasional submarine that might slip through the narrow Strait of Gibraltar), the Mediterranean theater remained inactive for the first nine months of the war. During this period the Allies took steps to improve their position and perfected their plans for joint action in the event of a hostile Italy. In June 1939, Lt. Gen. (later Field Marshal) Sir Archibald Wavell (later 1st Earl Wavell) was appointed commander in chief of all British land forces in the Middle East with headquarters in Cairo. The first contingents of Australian and New Zealand troops arrived in Egypt to reinforce his command in February 1940.

On May 10, Winston Churchill became prime minister and minister of defense, and on the same day, Hitler's armies invaded France, Belgium, the Netherlands, and Luxembourg. German success was spectacular. By June 22, France had signed an armistice with Germany, and hostilities had ended; the British Expeditionary Force had withdrawn to the United Kingdom; and the northern half of France and all of Belgium, the Netherlands, and Luxembourg became German-occupied countries. Meanwhile, on June 10, Italy had declared war on Great Britain and France (effective June 11). France also signed an armistice with Italy, on June 24, and the British Commonwealth was then alone in arms against Germany and Italy.

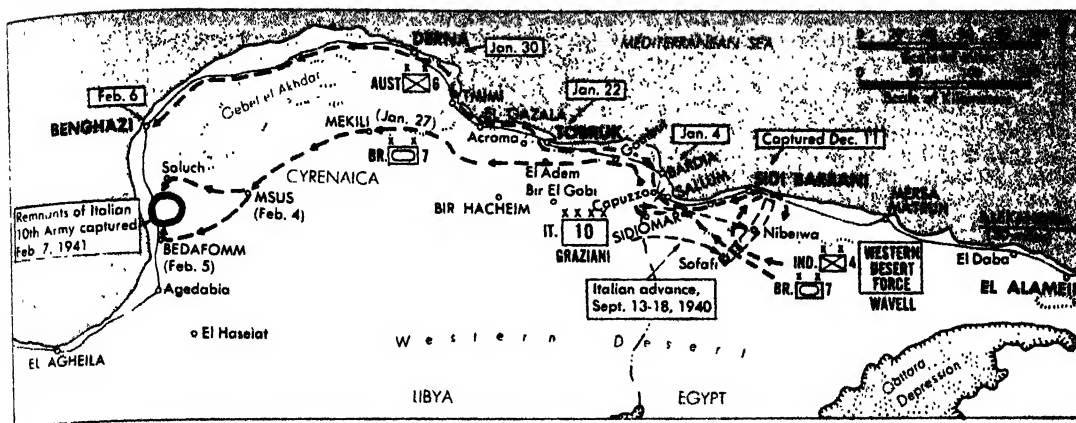
The effect of these events on the Mediterranean theater was alarming from the British point of view. The authorities in French North Africa, the other French African dependencies, and Syria decided to recognize the new French government at Vichy under Marshal Philippe

Pétain and to obey his orders. The carefully laid Anglo-French plans for joint action had collapsed. The burden of keeping open sea communications in the Mediterranean, defending the Suez Canal, and dealing with the Italians in East Africa now fell entirely on the British Navy and on General Wavell's scanty forces centered in Egypt.

As of the beginning of June, the Commonwealth had 1 battleship, 1 six-inch cruiser, and 1 destroyer based on Gibraltar, and 4 battleships, 8 six-inch cruisers, 1 aircraft carrier, and 21 destroyers in the eastern Mediterranean based on Egypt, while Italy had 6 battleships (2 of which did not join the fleet until July), 7 eight-inch cruisers, 12 six-inch cruisers, and 50 destroyers. Commonwealth land forces included 1 armor division, 1 incomplete Indian division, 1 New Zealand brigade, 1 horsed cavalry division, part of an Australian division, 2 independent cavalry regiments, 19 British infantry battalions, and 1 artillery regiments, totaling about 63,500 troops in Egypt and Palestine; and about 9,000 troops in the Sudan, 1,500 troops in British Somaliland and 8,500 troops in Kenya, or a total of about 19,000 in East Africa. Italy had 9 metropolitan (regular) divisions, 3 Black Shirt divisions, and 2 Libyan native divisions, totaling about 200,000 troops in Libya; and about 91,000 European and 199,000 native troops, with 400 guns and 200 light tanks, in East Africa. The Commonwealth units were generally considerably under strength, but those of the Italians were at full strength. British Commonwealth aircraft of all types numbered 375 (205 in Egypt and Palestine and 170 in East Africa); Italian aircraft, 633 (313 in Libya and 325 in East Africa).

In addition to General Wavell, the principal commanders on the British Commonwealth side were Adm. (later Admiral of the Fleet) Sir Andrew Cunningham (later 1st Viscount Cunningham of Hyndhope) and Air Chief Marshal Sir Arthur Longmore, in charge, respectively, of naval and air operations in the Mediterranean and Middle East. Gen. (later Field Marshal) Sir Henry Maitland Wilson (later 1st Baron Wilson of Libya and of Stowlangtoft) was in command of British troops in Egypt; Lt. Gen. (later Gen. Sir) Richard N. O'Connor, of the Western Desert Force; Lt. Gen. (later Gen. Sir) William Platt, of troops in the Sudan; and Lt. Gen. Douglas P. Dickinson, of the East African Force, based on Kenya. General Dickinson was replaced by Lt. Gen. (later Gen. Sir) Alan G. Cunningham, younger brother of Admiral Cunningham, on November 1. On the Italian side Marshal Italo Balbo, who was killed in an air accident in June, was succeeded as commander in chief in Libya by Marshal Rodolfo Graziani. The duke of Aosta served as viceroy and commander in chief in Italian East Africa.

**First British Offensive in North Africa: June 1940–February 1941.**—The first clash between British and Italian forces took place in the Western Desert in the early hours of June 11 before the Italian troops concerned had been told of the declaration of war. During the next six months the British carried out many small raids against Italian positions in Libya. In addition there were numerous patrol clashes in which the superiority of the British Commonwealth troops became apparent. On July 3, the British Navy sank or put out of action a number of units of the French Fleet at Oran and Mers-el-Kebir in



Map 28. ITALIAN DEFEAT IN LIBYA (Sept. 13, 1940–Feb. 7, 1941). In mid-September 1940, Marshal Rodolfo Graziani marched his huge Italian army across the Libyan border into Egypt. Though outnumbering the British by five to one, he advanced only as far as Nibeiwa and Sofafi, and established defensive positions on a line through the two villages. On December 9, the British launched an offensive that was to carry them 500 miles across northeastern Africa. (The term "Western Desert," used to designate the portion of the Libyan Desert in Cyrenaica and Egypt in which the fighting took place, is sometimes confined to the western frontier area of northern Egypt.) Key points along the coast fell on the dates shown, each with a sizable bag of Italian prisoners. What remained of the Italian Tenth Army was rounded up and captured south of Benghazi on Feb. 7, 1941. The British then advanced outposts to El Agheila. It was a spectacular British performance. Though greatly outnumbered, they captured 130,000 prisoners and many tanks, artillery pieces, and vehicles at very small cost to themselves. A sudden need to send troops to Greece deprived Gen. Sir Archibald Wavell of the opportunity to capture the principal Italian base at Tripoli and drive the Italians from Africa.

order to prevent their falling into German hands. French warships at Alexandria were immobilized on the following day. Later, on September 23–25, British and Free French forces failed in an attempt to land at the Vichy French port of Dakar but succeeded in badly damaging the battleship *Richelieu*. Meanwhile, between September 13 and September 18, the Italians advanced in strength approximately 60 miles into Egypt but halted at Maktila, east of Sidi Barrani. It was a disappointment to the British that they did not advance farther, for plans had been made to deal them a heavy blow with the 7th Armored Division as they approached Matruh. During the advance the Italians lost more than 3,000 men; the British, about 150.

On October 28, Italian troops based on Albania invaded Greece. A fortnight later, on November 11, the British Fleet Air Arm attacked the Italian Fleet at Taranto and, for a loss of two aircraft, put half of its major units out of action for about six months.

In December, the Western Desert Force, consisting of the 7th Armored Division and the Indian 4th Division, began the first major British offensive in North Africa. Operations were under the direction of General Wavell, with General O'Connor in executive command. The offensive began on December 9, and by December 11, Sidi Barrani had been taken with a loss to the Italians of 38,300 prisoners. Important decisions now had to be made. The offensive had been planned to last no more than five days and to stop after the capture of Sidi Barrani. Its success had greatly exceeded expectations, and General Wavell, urged by General O'Connor, agreed to the continuance of the advance. Arrangements had been made, however, to send the Indian 4th Division to East Africa, where it was required for offensive operations: shipping was already standing by at Suez to carry it to Port Sudan. The Indian division was therefore withdrawn from the Western Desert Force on December 14,

and replaced immediately by the Australian 6th Division, but the exchange caused a delay in the resumption of the offensive.

Successes followed in quick succession. Bardia was captured on Jan. 4, 1941 (32,000 prisoners were taken), and Tobruk on January 22 (about 25,000 prisoners). By this time the Italian Tenth Army (together with considerable reinforcements sent from the Fifth Army in Tripolitania) had been greatly depleted in strength, and General O'Connor decided on a bold step to complete the destruction of the Italian forces in Cyrenaica. This plan required the 7th Armored Division to make a desert march to Beda Fomm near the coast with a view to getting behind and cutting off the remaining Italian troops, while the Australian 6th Division was to advance on Benghazi by the coastal route. This operation was completely successful. The 7th Armored Division reached Mechili (El Mechili) on January 27, Msus on February 4, and the Beda Fomm area on February 5. Meanwhile, the Australian 6th Division, having captured Derna on January 30, advanced on Benghazi, which it reached on February 6. After some brisk fighting at Beda Fomm, in which gallant efforts were made to break through the British positions, the Italians surrendered on the morning of February 7. There were about 25,000 prisoners, including Gen. Giuseppe Tellera, commander of the Tenth Army, who was mortally wounded. Immediately after the surrender a small protective group was established at El Agheila, with patrols out for 40 miles along the coast toward Sirte.

The campaign had been a remarkable success. The 13th Corps (as the Western Desert Force was renamed on Jan. 1, 1941) had never exceeded a strength of 31,000 men. Between Dec. 9, 1940, and Feb. 7, 1941, it had advanced more than 500 miles and captured more than 130,000 prisoners, about 400 tanks, nearly 850 guns, and thousands of wheeled vehicles. The 13th Corps'

own losses were about 500 killed, 1,373 wounded, and 55 missing.

With the destruction of the Italian Tenth Army and the occupation of the whole of Cyrenaica, the British were faced with a difficult problem. The only Italian forces left in North Africa were 5 very weak and dispirited divisions of the Fifth Army around the port of Tripoli. General O'Connor was confident that the 13th Corps could advance and capture Tripoli, with the prospect of eliminating all Axis forces from North Africa, and he immediately drew up plans for doing so. There was, however, another urgent call in a very different direction. When the Italians began invading Greece, they had met with some initial success, but very soon the Greeks counterattacked and drove them back into Albania. Partly to help their ally and partly for other reasons, the Germans decided to advance through Yugoslavia and occupy Greece. German preparations for this move had been apparent to the British intelligence service for some time. Hitherto the Greeks had declined British aid, but on Jan. 29, 1941, Premier Ioannes Metaxas died, and his successor, Alexandros Korizis, intimated that he would welcome British help against what he regarded as an imminent German threat. British resources in the Middle East were insufficient to allow both an advance to Tripoli and aid to Greece. After numerous exchanges of views between the British government and General Wavell and discussions in Cairo and Athens (Athenai), which were attended by Foreign Secretary Anthony Eden and the chief of the Imperial General Staff, Gen. (later Field Marshal) Sir John Greer Dill, it was decided to send a force to Greece and remain on the defensive in North Africa.

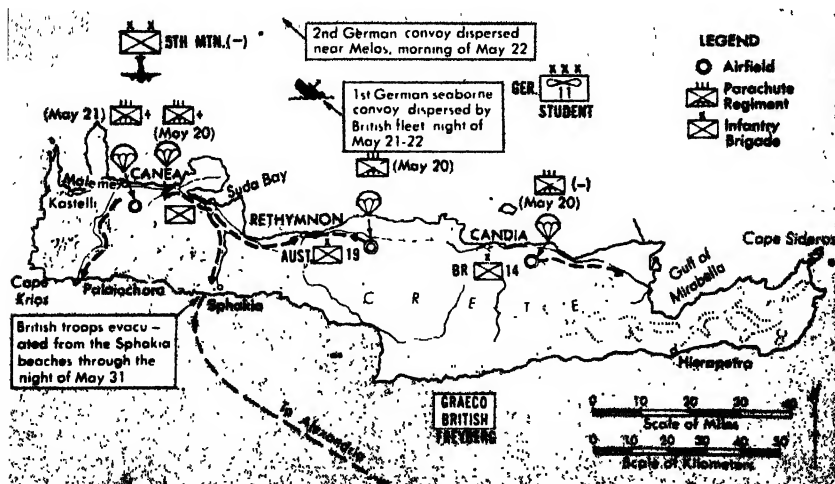
**British Expedition to Greece and Crete: April-May 1941.**—The force sent to Greece was commanded by General Wilson and consisted of about 24,200 British (including an armored brigade), 17,100 Australian, and 16,700 New Zealand troops. The dispatch of British troops from Egypt began on April 5, and on the following day, German forces invaded Yugoslavia and Greece. By April 16, British and Greek forces had been withdrawn to a front south of Mount Olympus (Olympos). In the face of superior German forces and of an Italian offensive from Albania, the situation deteriorated

rapidly. The decision was made to withdraw British Commonwealth forces from Greece, and the withdrawal was carried out between April 24 and May 1. Meanwhile, on April 27, German troops entered Athens.

From the outset the British authorities had realized the risks involved in the Greek venture, but the political advantages were thought to outweigh the military hazards. Viewed in the light of later knowledge, it seems that the chances of success were remote in the extreme. The expedition was hurriedly planned, the headquarters was an improvised one, the troops were not the most experienced or the best trained, and the Greeks, although brave, were ill equipped. The expedition cost the British approximately 12,000 casualties. In contrast, the German invasion of Greece was carefully planned and made in considerable strength, with well-equipped and well-trained troops. The Greek expedition deprived the British of the chance of seizing Tripoli and of expelling the Italians from North Africa.

Following the decision to evacuate British troops from the Greek mainland, the question arose as to whether Crete should be held. Prime Minister Churchill insisted that it must be held, and on April 30, General Wavell flew to the island to discuss plans for its defense. Maj. Gen. (later Lt. Gen.) Bernard Freyberg (later 1st Baron Freyberg), commander of the New Zealand Division, was placed in command. By May 3, he had disposed his troops as follows: the 14th Infantry Brigade at Candia (Herakleion), the Australian 19th Brigade at Rethymnon (Retimo) and Georgeopolis, a composite force of 14,800 men in the Suda Bay-Canea (Khania) area, and two brigades of New Zealanders in the Maleme Airfield sector. In addition, Greek battalions were distributed among the various sectors. The total strength was about 42,500 troops. Many of them had recently been fighting on the mainland, some were comparatively untrained administrative personnel, and there was an acute shortage of arms and heavy equipment.

Under the direction of Gen. (later Col. Gen.) Kurt Student and the executive command of Col. Gen. Alexander Löhr, the Germans decided to attack and capture the island mainly with airborne troops. The aircraft available consisted of about 500 serviceable bomber, fighter, and reconnaissance planes, about 500 transport air-



craft, and 72 gliders. The bombing of Allied positions and installations began on May 14, and the first airborne troops landed on May 20. The capture of Maleme Airfield on the following day enabled the Germans to fly in reinforcements rapidly. As the Germans built up their strength, the British position gradually deteriorated. By May 24, General Freyberg had abandoned hope of holding Crete, and, in view of the heavy losses being suffered by the Royal Navy, the decision to evacuate the island was made on May 27. Severe losses were sustained in attempts to embark troops from the northern parts of the island. The last evacuation was made from a beach at Sphakia (Chora Sphakion) on the south coast on May 31. Allied casualties in the campaign were about 17,500 killed, wounded, and prisoners; German losses, just over 6,000. In addition, 9 British warships were sunk, and 17 were damaged.

For a more detailed account of operations in Greece in 1941, see section 7. *Balkan Campaigns.*

**Iraq and Syria: April–June 1941.**—In 1941, Italy's ally, Germany, began to interest herself in Iraq and French-held Syria. On April 3, a pro-German politician, Rashid 'Ali al-Gailani, brought off a successful coup d'état in Iraq. At the same time, reports reached General Wavell that German cadres of officers and technicians were arriving in Syria in French aircraft.

On April 17, an Indian brigade was sent to protect the oil pipeline running from Iraq to Haifa. British Commonwealth forces engaged the insurgent forces in Iraq on May 2, and on May 31 occupied Baghdad. The pipeline was secured, and the regent, Emir 'Abdallah, was reinstated.

By June 8, it was clear that German forces had infiltrated into Syria in some strength, and that the Vichy commander, Gen. Fernand Dentz, was supporting them. In the next six days, British Commonwealth forces under General Wilson advanced into Syria and, in a sharp campaign, defeated the Vichy forces and occupied the country.

**East Africa and the Red Sea: June 1940–November 1941.**—Because of the negligible strength of British forces in East Africa, the four months following Italy's declaration of war saw a number of Italian successes. In the Sudan, Italian troops occupied the frontier towns of Kassala and Gallabat on July 4, 1940, and in Kenya they captured Moyale on July 15. Then, between August 5 and August 19, they occupied British Somaliland.

By November 1940, the British were able to adopt a more aggressive attitude, though still on a limited scale, and by February 1941 they were in a position to mount a large-scale offensive. The situation was also greatly improved by the growth of a considerable patriot movement in Ethiopia, where native forces organized by Maj. (later Maj. Gen.) Orde C. Wingate and other British officers were increasing rapidly in strength and efficiency. At the time the offensive started, the Indian 4th and 5th divisions were stationed in the Sudan. In Kenya the units were more diversely organized and of more varied composition. Of the 77,000 troops in the area, 27,000 were European South Africans; 6,000, Europeans serving in East and West African forces; 33,000, East Africans; 9,000, West Africans; and 2,000, of various nationalities.

The British plan called for an advance eastward from the Sudan through northern Ethiopia

to Eritrea and the Red Sea, together with an approximately simultaneous advance northward from Kenya through southern Ethiopia to the capital, Addis Ababa, and also eastward from Kenya to Italian Somaliland. The terrain in many parts of this area affords a striking contrast to the Western Desert. Much of Ethiopia is mountainous with wide and torrential rivers. The country favors highly trained troops, and it also gave the Ethiopian guerrillas full scope.

The British offensive started early in February. Progress was rapid, and the various columns inflicted heavy losses on the Italian troops and took large numbers of prisoners. By February 25, forces from Kenya had captured most of Italian Somaliland, including the ports of Kismayu and Mogadishu. A force from Aden, escorted by warships, landed at Berbera on the coast of British Somaliland (Somaliland Protectorate) on March 16. On April 6, Addis Ababa was occupied. Meanwhile, forces from the Sudan captured Keren, Eritrea, on March 27, and by April 4 the area between Lake Tana and Addis Ababa had been occupied. Mas-sawa was occupied on April 8. On May 16, after stubborn fighting, the duke of Aosta surrendered at Amba Alagi (the formal surrender took place on May 20). Organized resistance ended, but isolated detachments continued to fight for some months, and it was not until November 27 that Gondar, the last place to hold out, surrendered.

The two most important battles of the East African campaign were those fought at Keren and Amba Alagi. The British land forces were well supported by the air force. Typical of this assistance were the attacks made by the South African Air Force on the airfield at Addis Ababa on April 4, 5, and 6, when about 30 Italian aircraft were destroyed.

All of the Italian forces, white and native, who had not been killed or who had not deserted (as many of the native troops had) became prisoners of war. Total Italian losses were estimated at 289,000. There had at times been serious fighting, but it is true to say that, from the British point of view, the East African campaign was a struggle against the climate and disease rather than against the Italian enemy. Between June 1940 and May 1941, British Commonwealth troops suffered only 1,154 battle casualties but 74,550 cases of sickness or accident, of which about 10,000 were due to dysentery and 10,000 to malaria; 744 of these died.

In East Africa as in other campaigns, Italian arms had not prospered. The campaigns in Africa, as well as that against the Greeks in Albania, had shown Italian troops to be poorly led and trained. They were badly equipped, especially in tanks, and logistically ill found. In Africa they had been completely defeated in two campaigns by British Commonwealth forces of greatly inferior strength. Not less than 420,000 Italians (including Italian-trained native troops) had been killed or captured, as compared with approximately 3,100 British Commonwealth battle casualties. The Italians also lost hundreds of tanks, guns, trucks, and aircraft and vast quantities of other equipment and stores. The collapse in East Africa was Italy's third serious defeat since entering the war. By early February 1941, she had been decisively beaten in Cyrenaica. By mid-March, her last effort to defeat the Greeks without German aid had failed. For the British the campaign in East Africa was the last of the easy victories. Thereafter they were to meet Germans, who were well led,



well trained, and well equipped.

**Arrival of the Germans in North Africa: February 1941–May 1942.**—After the Battle of Bedafohm in February 1941, the bulk of the British forces in the Western Desert were withdrawn in preparation for the expedition to Greece. The defense of Cyrenaica was then left to the Australian 9th Division and part of the 2d Armored Division. Later the Indian 3d Motor Brigade was sent to the desert as a reinforcement. This force, which was much less experienced than the Australian 6th Division and the 7th Armored Division which it had replaced, was under the command of Lt. Gen. (later Sir) Philip Neame.

Up to this time the Germans had participated in the Mediterranean operations only in the air (since early January, the Luftwaffe had made attacks on British warships and convoys from Italian airfields). The predicament of the Italian forces in North Africa after their serious defeats in Cyrenaica, however, had convinced the German High Command that a substantial force must be sent to the assistance of their Axis partner. The decision to do so had been made on January 11, and on February 5 the formation of the German Africa Corps was made known to the Italians. The new corps, which was to consist of the 5th Light Motorized Division and the 15th Panzer Division, was placed under the command of Lt. Gen. (later Field Marshal) Erwin Rommel. Within three months, German efficiency and equipment and Rommel's skill in armored warfare, combined with the reduction in British strength, were to change the whole position in North Africa and see the British driven back to the Egyptian frontier.

Rommel arrived in Tripoli on February 12, and at once began organizing the defenses of the area with such Italian troops as were available and making plans for offensive action as soon as the Africa Corps arrived. General Wavell and his intelligence staff estimated that Rommel would not be able to stage a major offensive before May 1. In this they were wrong. In early March, there were a number of clashes between the opposing light forces in the El Agheila area. Then, on March 24, Axis forces occupied El Agheila, and on April 1 they took Mersa Brega. Thereafter their advance was rapid. The weak British forces were outmaneuvered and thrown into confusion. On April 3, Benghazi fell, and on April 7, Generals O'Connor and Neame were captured by a German reconnaissance unit. Mekili was taken the next day, and by April 11, Axis forces had reached Bardia and Sallum. In the face of this serious threat to the Suez Canal, General Wavell had decided to hold the port of Tobruk with the Australian 9th Division, the Australian 18th Brigade, and some armored and other ancillary units. Their task was facilitated by the existence of the old Italian defense works on the landward side, which were still in fairly good condition. By April 11, Tobruk had been invested, but the speed with which Rommel's forces pressed on past the port made it apparent to Wavell that the Axis objective was the Suez Canal, and that it was necessary to make a stand somewhere in the neighborhood of the Libyan-Egyptian frontier. The reconstituted Western Desert Force, consisting of all the troops Wavell could make available, was put under the command of Lt. Gen. Sir Noel M. de la P. Beresford-Pease; it comprised the Indian 4th Division, the

Australian 7th Division, the incomplete 6th Division, and a mobile force equivalent to a brigade.

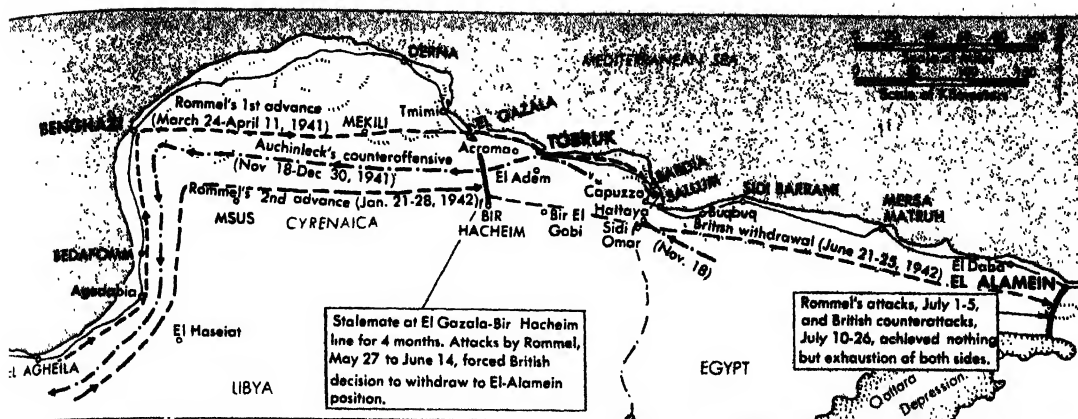
Between April 13 and April 17 and again between April 30 and May 4, Axis troops unsuccessfully attacked Tobruk. Meanwhile, British defenses along the Egyptian frontier had been organized, and it soon became clear that this factor, combined with the threat to their flank from Tobruk and logistic difficulties, had brought the Axis offensive to a halt. Between May 15 and May 17, the British carried out a local offensive in the Halfaya-Sallum-Capuzzo area. Although this offensive was partially successful, the Germans recaptured Halfaya on May 27.

Meanwhile, on May 12, a sea convoy code named Tiger had arrived in Egypt with 82 cruiser tanks, 135 infantry tanks, and 21 light tanks, and this made it possible to start rebuilding the 7th Armored Division. By the end of the month, the British forces had been reorganized and reequipped sufficiently to assume the offensive, and on May 28, General Wavell issued orders for Operation Battleaxe. The Western Desert Force was to defeat the enemy on the frontier and occupy the Bardia-Sallum-Capuzzo-Sidi Azeiz area, then attack the enemy around Tobruk and relieve the port, and finally move on Derna and Mekili. The forces available were the 7th Armored Division, the Indian 4th Division, the Indian 11th Infantry Brigade, and the 22d Guards Brigade. Axis forces consisted of the 15th Panzer Division in the frontier area, with three Italian infantry battalions around Capuzzo and the rest of the weak Trento Division and Bardia.

The attack began on June 15 and achieved some initial success, but on the following day progress was slow, and further advance was checked by enemy counterattacks. By the morning of June 17, losses in tanks and the generally unfavorable situation made it clear that the attack had failed. The order to withdraw was given, and the British forces retired to their original area. British casualties totaled about 960. Of 90 cruiser and about 100 infantry tanks which began the battle, 27 cruisers and 64 infantry tanks were lost. The air force lost 36 aircraft. The Axis forces sustained about 800 casualties, mostly Germans. They had 12 tanks destroyed and about 50 damaged; and they lost 10 aircraft.

The British failure in Battleaxe was attributable to the haste with which it was mounted, the lack of opportunity to train the troops with new equipment, and the lack of tactical training, especially in armored units. Cooperation between air and ground forces also left much to be desired. The Axis defenders occupied well-prepared positions and showed marked skill in handling their antitank weapons and in staging counterattacks. It was clear to the British that a much greater effort was required if the Axis forces were to be eliminated from North Africa. The next six months were to be a period of preparation by both sides. Meanwhile, on June 22, Germany attacked the USSR, and Prime Minister Churchill at once acclaimed the Soviets as an ally with whom his country would cooperate to the fullest extent.

On July 5, General Wavell was replaced as commander in chief in the Middle East by Gen. (later Field Marshal) Sir Claude J. E. Auchinleck. It would be hard to imagine a more difficult military task than that which had faced General Wavell during his two years in command. With the entry into the war of Italy and the



Map 30. BRITISH AND AXIS OPERATIONS IN LIBYA AND EGYPT (March 24, 1941–July 26, 1942). The map shows schematically the British and Axis seesaw operations during the period covered. Vast distances across the sandy wastes posed problems of vehicle maintenance and of supply (water was a major one) that had marked effect on the conduct of operations. As one force fell back on its base, it became relatively stronger; meanwhile, logistical problems made the opponents progressively weaker as they moved farther and farther from their own base. At the end of the exhausting operations in July 1942 along the El Alamein line, Field Marshal Erwin Rommel was in a most hazardous position, logistically and strategically.

all of France, he found himself with totally inadequate forces, imperfectly trained and not fully equipped. He was outnumbered on all fronts. In less than 12 months he had completely defeated the Italians in North Africa and East Africa, and had killed or captured more than 400,000 of the enemy at a cost of just over 3,000 British Commonwealth casualties. These results were attained despite distractions in Syria and Iraq. In April, on political grounds, he was compelled to send a large force to Greece, but in spite of this contingency and the arrival of the German Africa Corps in North Africa, he succeeded in carrying out his main task, which was the defense of the Suez Canal. Those Allied commanders who came to the Middle East and the Mediterranean later never experienced the same difficulties: their resources in men and materials were incomparably greater.

During the summer of 1941 there was little change in the dispositions of either side. Planning for the next British offensive, known as Operation Crusader, began in August. On September 18, the Western Desert Force was redesignated the Eighth Army and placed under the command of General Cunningham, who had earned such a high reputation in East Africa. Meanwhile, in July, there were reports of German intrigues in Iran, and on August 17, a joint Anglo-Soviet note was sent to the Iranian government. British forces from India entered the country on August 25. There was some resistance at first, but it ceased by August 28. At about the same time, Soviet forces entered Iran from the north, and on September 17, British and Soviet troops occupied Teheran, the capital. The occupation of Iran prepared the way for the development of a supply route to the USSR. While these events had no influence on the war in the Mediterranean, the denial to the Germans of access to that part of the world relieved General Auchinleck of any anxiety from that quarter.

By the beginning of November, plans had been completed for Operation Crusader. The twofold objective of the operation was the relief of Tobruk and the occupation of the whole of Cyrenaica, to which General Auchinleck added the rider that this must be accompanied by the

destruction of the enemy's armor. The British Eighth Army (including the Tobruk garrison) consisted of 1 armored division, 3 armored or tank brigades, and the equivalent of 6.5 infantry divisions, or about 118,000 troops. There were about 680 British tanks, with 500 tanks in reserve or on the way to North Africa. The Axis forces comprised 2 German and 1 Italian armored divisions and 1 German and 6 Italian infantry divisions, or about 119,000 troops. There were about 390 German and Italian tanks, with practically no reserves. The German-Italian numerical inferiority in armor was in some respects compensated by the superiority of their best tanks in performance and gun power. The real superiority of the Axis lay, however, in antitank guns that fired a much heavier missile than the British 2-pounders, had a much longer range, and were handled with great skill.

The offensive began on November 18. The first attempt to relieve Tobruk failed, and British losses in armor were heavy. On November 26, General Auchinleck relieved General Cunningham of command of the Eighth Army on the ground that his plans for the future were not sufficiently aggressive. Cunningham was replaced by Maj. Gen. (later Gen. Sir) Neil M. Ritchie, who had been deputy chief of staff in the Middle East. The offensive was resumed on December 5, and on December 10, Tobruk was relieved. The Axis forces withdrew from El Gazala on December 16, and on December 24, British troops entered Benghazi, having advanced about 300 miles. There the offensive ended. The Eighth Army had attained its first objective, the relief of Tobruk. It had also occupied Cyrenaica, although the occupation was to be a fleeting one. It destroyed many Axis tanks, but its own losses were also very heavy. The German Africa Corps showed remarkable powers of recovery, and on Jan. 21, 1942, Rommel resumed the offensive. By January 28, the British had withdrawn from Benghazi to the El Gazala-Bir Hacheim line. There was then a lull in the Western Desert until the end of May.

Since Operation Crusader began in November 1941, British casualties had totaled about 17,700, and those of the Axis about 38,300. Tank losses



Camera Press-Pix

Residents of Malta take shelter in an underground gallery during one of the numerous Axis air attacks. Because of their bravery, the island was awarded the George Cross.

are more difficult to assess accurately. Up to December 12, the 7th Armored Division suffered 526 battle casualties and breakdowns in tanks, of which about 281 became battleworthy again. How many again took part in Crusader is not known. In addition, more than 200 British infantry tanks became casualties, although many of these were eventually recovered and used again. Axis losses in tanks were around 340, many of which were recovered and repaired. British losses in aircraft totaled about 300; those of the Axis, about 332. Crusader was a British victory, but the price paid, especially in tank losses, was heavy. It was apparent that British equipment and standards of tactical training, although more than a match for Italian troops, were still below those of the German Africa Corps.

Meanwhile, outside the Mediterranean theater, great events had taken place. On Dec. 7, 1941, the Japanese delivered a crippling air assault against the United States naval base of Pearl Harbor. This brought the United States into the war against Germany and Italy. With Britain, the Soviet Union, and the United States in alliance, eventual victory over Germany and Italy, and the new Japanese enemy, seemed certain.

**Naval Operations in 1941.**—As all British Commonwealth personnel and supplies for the land forces in the Mediterranean had to come by sea, except for a small proportion sent by air, it was of vital importance to keep water communications open. This was comparatively easy in the Indian Ocean and Red Sea, through which reinforcements and supplies from Australia, New Zealand, India, and, frequently, North America, arrived, although there was some anxiety for this route when Japan entered the war. The Mediterranean was, however, by far the more important area of naval warfare. There the British and Italian navies, supported by seaborne and shore-based aircraft, strove to safeguard their own communications and cut those of their opponents.

After the attack on Taranto by British air-

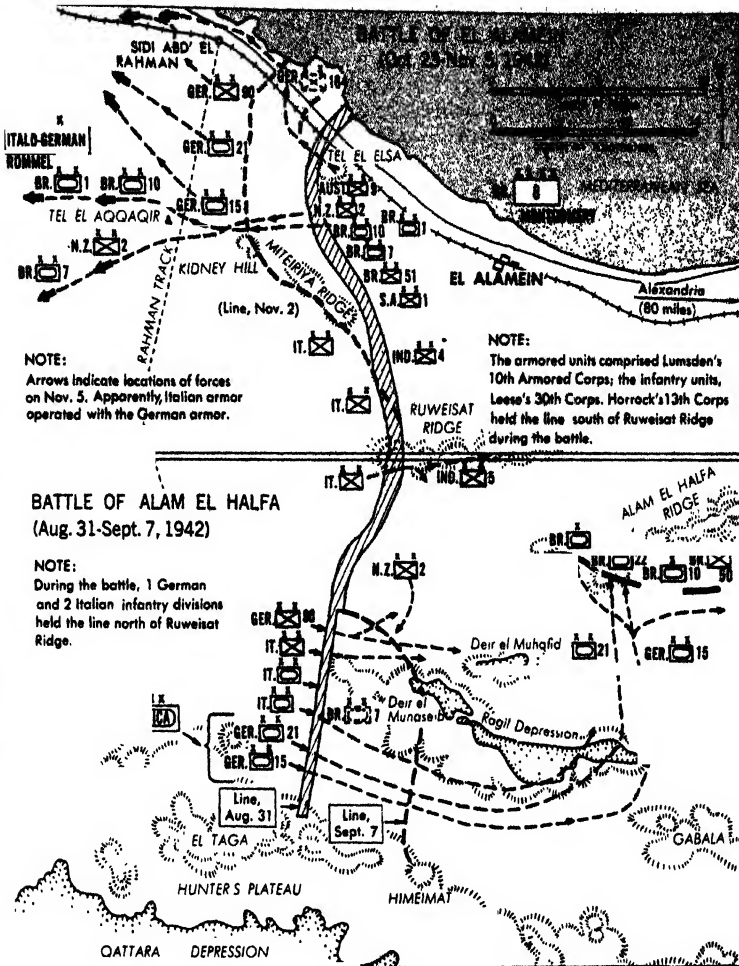
craft in November 1940, the chief events of naval interest were the bombardment of Genoa (Feb. 9, 1941), the British naval success at Cape Matapan (Tainaron; March 28), and numerous actions and convoy work connected with the British expedition to Greece and the subsequent occupation of Crete (April-May). An Italian motorboat attack on the harbor of Valletta, on July 25-26, was completely defeated, but the British subsequently lost the warships *Ark Royal* (November 13) and *Barham* (November 25), and attacks by Italian "human torpedoes" on the harbor of Alexandria resulted in severe damage to the *Queen Elizabeth* and the *Valiant* (December 19).

Throughout 1941, Malta was a target for Axis shore-based aircraft. The many attempts to reinforce, revictual, and fly fighter aircraft to Malta from aircraft carriers cost the British many lives, the carrier *Ark Royal* and numerous other warships, and many merchant ships, valuable cargoes, and aircraft. But Malta held out and was of incalculable value during the Allied invasions of Sicily and the Italian mainland in 1943.

**British Defeats in North Africa and the Turn of the Tide: May-November 1942.**—At the beginning of May 1942, the British war cabinet was pressing for an early offensive in the Western Desert, and General Auchinleck made the necessary plans. In this he was anticipated by General Rommel, as on May 27, Axis forces attacked the El Gazala-Bir Hacheim position in strength. For several days the battle hung in the balance, but on June 5 the Axis began to get the better of the fighting, and there followed a series of disasters for the British. By June 12, the so-called "Cauldron" Battle had been lost; the Free French troops, after heroic resistance at Bir Hacheim, had been withdrawn; and British armor had suffered a major defeat. The decision to withdraw from the El Gazala line was made on June 14. On June 21, the mainly South African garrison of Tobruk was forced to surrender. Four days later, General Auchinleck assumed direct control of the Eighth Army, which took up a defensive position running from north to south, with its right on the sea near El Alamein and its left on the Qattara Depression. Attempts by Rommel to break through this position between July 1 and July 5 failed, and on July 10, General Auchinleck started a series of counterattacks with limited objectives that lasted until July 26. By this time both sides were exhausted, the British through a series of defeats and heavy losses, and the Axis mainly because of logistic difficulties but also because of considerable casualties. Once again German armor had demonstrated its superiority in material qualities, training, and tactical handling. It was, however, the last Axis success in Africa.

Between August 4 and August 10, Prime Minister Churchill visited Cairo and held a series of meetings, in which he was joined by Field Marshal Jan Christian Smuts, prime minister of South Africa; Gen. (later Field Marshal) Sir Alan F. Brooke (later 1st Viscount Alanbrooke), chief of the Imperial General Staff; and General Wavell, who was now commander in chief in India. As a result, major changes were made. On August 13, Lt. Gen. (later Field Marshal) Bernard Law Montgomery (later 1st Viscount Montgomery of Alamein), assumed command of the Eighth Army, and two days later Gen. (later Field Marshal) Sir Harold Alexander (later 1st Earl Alexander of Tunis) succeeded General

Map 31. BATTLES OF ALAM EL HALFA AND EL ALAMEIN (Aug. 31–Nov. 5, 1942). Appreciating his poor strategic position at El Alamein, Field Marshal Erwin Rommel decided to attack to reach a decision. The pattern of warfare in northeastern Africa had developed into one of envelopment by armored forces. Lt. Gen. Bernard Law Montgomery, knowing this and lacking complete confidence in the operational abilities of his new armored units, had them dig into defensive positions on Alam el Halfa Ridge to meet the inevitable German envelopment. Rommel, as expected, burst through the weak southern part of Montgomery's line and turned northward to complete his envelopment. At the ridge he met the dug-in British tanks; frustrated and short of fuel, he withdrew his forces. Montgomery did not pursue the enemy, but prepared for a deliberate offensive. This came in the north several months later. It was not an easy operation. The German and Italian armor had shifted northward to meet the blow, and a slugging match ensued. Eventually, through sheer superior power, Montgomery's forces broke through and forced a general Italo-German retreat. Logistical and other considerations delayed Montgomery's pursuit, and Rommel reached Tunisia in time to engage in the final Allied-Axis operations for the control of Tunisia.



Auchinleck as commander in chief in the Middle East. A number of lesser appointments also changed hands about this time.

The directive given by Churchill to General Alexander stated that his main duty was to destroy as early as possible the German-Italian army commanded by the recently promoted Field Marshal Rommel. Immediately after General Montgomery took command of the Eighth Army, he began the task of reorganizing and redispersing his troops. He also made known that there would be no further retreat, and that, if attacked, the army would fight where it stood, on what was known as the Alam el Halfa position. The British had not long to wait, for by August 25 it was apparent that Rommel was about to assume the offensive. Available to him for this operation were 4 German and 6 Italian divisions, of which 2 German and 2 Italian divisions were armored. To meet this force, Montgomery had 7 divisions, of which 2 were armored.

The attack began against the southern flank of the Alam el Halfa position in the early hours of August 31. Fighting continued throughout that day and the next, but the British held fast. By the evening of September 2 the Axis armor was short of fuel, and, with little prospects of success, Rommel began to withdraw his forces. He was in full retreat by the following day. The retreating Axis columns were heavily attacked

from the air, but Montgomery did not press the pursuit with his ground troops. For this he was criticized in some quarters, but he suspected a trap to lure his armor onto the powerful and numerous Axis antitank guns and was doubtful if his troops were yet a match for the Germans in fluid operations. By September 7, the battle was over.

After Alam el Halfa, Churchill pressed strongly for an early offensive, but Montgomery was adamant that this would be unwise. He informed the prime minister that an early offensive would fail, but that he guaranteed the success of one late in October. Meanwhile, the greatest energy was displayed throughout the Eighth Army to accustom the troops to new equipment (which was now being delivered in increasing quantities), to reorganize the forces, and above all to improve the standard of tactical training. By October 20, all was ready for the Battle of El Alamein. Montgomery disposed of the equivalent of 11 divisions (3 armored), organized in three corps. To meet this force Rommel had 13 divisions, 4 of which were German. Of his 4 armored divisions, 2 were German and 2 Italian. The British attack opened on the night of Oct. 23–24 with a massive artillery bombardment. Bitter fighting continued for several days, during which both sides lost heavily and fortunes fluctuated. After a short pause to regroup, Montgomery re-

newed the attack on November 2. By November 5, the battle had turned in favor of the British, and Rommel began to withdraw, pursued by the British 30th Corps (the 1st and 7th armored divisions and the New Zealand 2d Division).

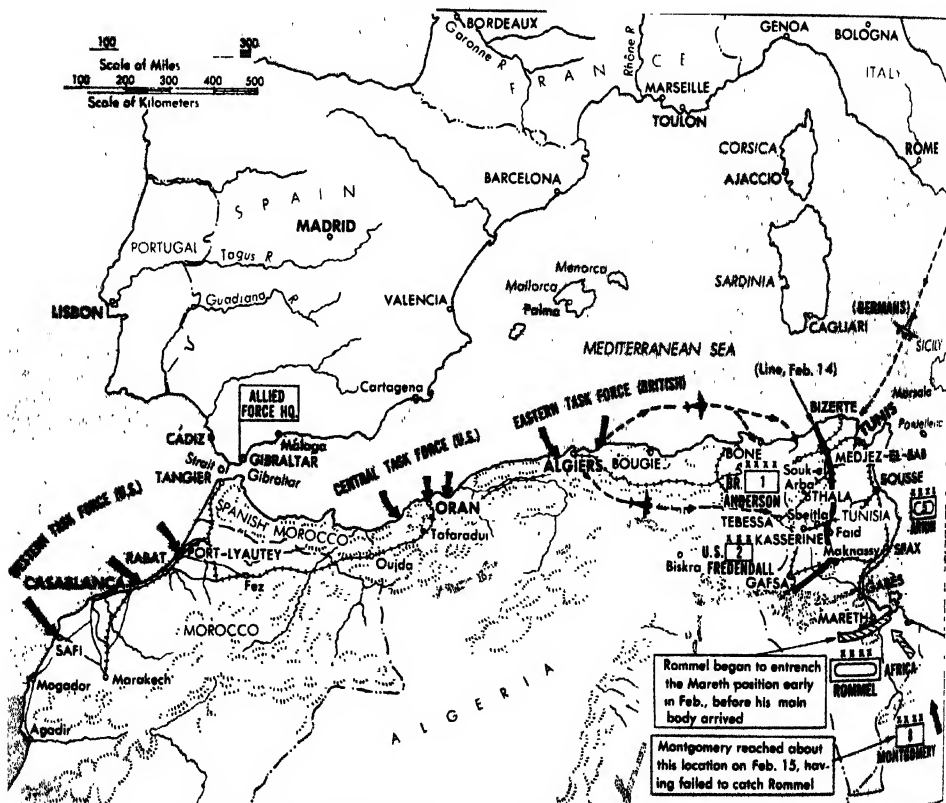
**Anglo-American Invasion of French North Africa: November 1942–May 1943.**—The Battle of El Alamein was not only the beginning of a series of unbroken victories; it was also the start of a new phase in North Africa. Henceforth the campaign in the Mediterranean was to be a joint Anglo-American undertaking. For some months the American and British staffs had been working on a plan for the occupation of French North Africa, with a view to the elimination of all Axis forces from Africa and as a preliminary to the invasion of Italy. At the end of August 1942, an Allied headquarters had been established in London for Operation Torch, the code name for the enterprise. The over-all command of sea, land, and air forces was vested in the American Lt. Gen. (later General of the Army) Dwight D. Eisenhower. The land forces consisted of the British First Army under Lt. Gen. (later Gen.) Sir Kenneth K. N. Anderson and the United States 2d Corps under Maj. Gen. (later Lt. Gen.) Lloyd R. Fredendall. Initially these formations

were very weak, the First Army being little more than a weak corps, but as the campaign proceeded they greatly increased in strength.

The first landings took place on November 8 and by the morning of November 11, Algiers (Alger), Oran, and Casablanca were in Allied hands. The French troops, acting under orders from the Vichy government, offered some resistance, but nowhere was this wholehearted, and in many places it was merely token. On November 11, all hostilities between the Allies and the French in Algeria and Morocco ceased, and on the following day, Adm. Jean François Darlan, now recognized as the French high commissioner in North Africa, handed over the French territories to the Allies and appealed to the French Fleet at Toulon to cross over to North Africa. Events moved quickly. By the end of November, the Germans had occupied the whole of France, and most of the French warships at Toulon had been scuttled by their crews. Meanwhile, the Axis forces in Tunisia were being heavily reinforced by air and through the ports of Bizerte and Tunis.

On December 11, the Allied advance in Tunisia was halted by Axis counterattacks in the area of Medjez-el-Bab. Then, on December 24,

Map 32. ALLIED INVASION OF FRENCH NORTH AFRICA (Nov. 8, 1942–Feb. 14, 1943). On Nov. 8, 1942, as Lt. Gen. Bernard Law Montgomery took up the pursuit of Field Marshal Erwin Rommel after the latter's defeat at El Alamein, Anglo-American forces landed in French North Africa, as shown on the map. The plan was to drive quickly to Tunis, cut off Rommel, and clear Africa of Axis forces. British amphibious and airborne troops sped to Tunisia to seize and hold advanced positions until the main Allied force arrived. The Germans began to rush reinforcements to Tunisia by air and by sea to thwart the Allied effort, and a race between the German buildup and the Allied advance began. By Feb. 14, 1943, the Germans had accumulated sufficient strength to stop the Allies on the line shown and to hold the gate open for Rommel.





In July 1942, the British Eighth Army was in position near El Alamein. Here Scots Guards are shown going into action in one of a series of counterattacks. After British strength had been built up by Lt. Gen. Bernard Law Montgomery, the Germans were decisively defeated in the battles of Alam el Halfa (August 31–September 2) and El Alamein (October 23–November 3).

Wide World



the already difficult political situation between the Allies and the French authorities was complicated by the assassination of Admiral Darlan. By this time the Allies were supported by numerous French troops under Gen. Henri Giraud; these, although at first inadequately armed, greatly improved in quality toward the latter stages of the campaign.

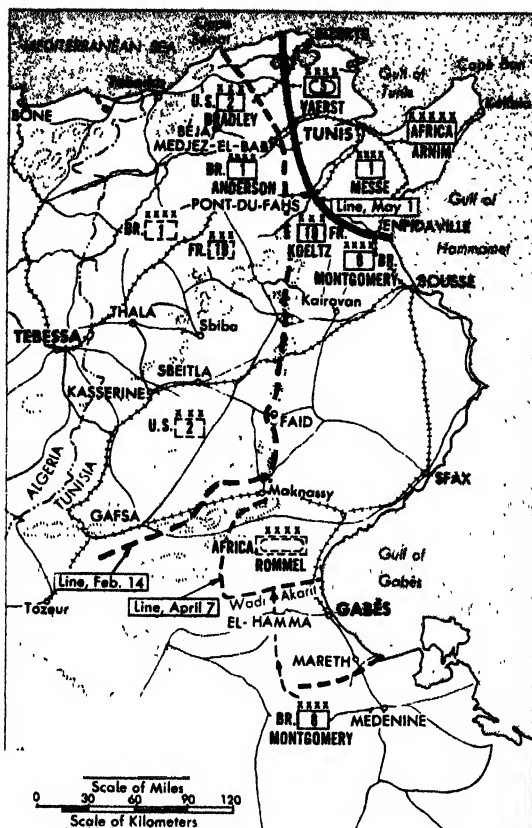
During January 1943, both sides confined themselves to local operations and attempted to build up sufficient strength for a decisive offensive. Then, on February 14, Axis forces launched a powerful attack against the United States 2d Corps, which, heavily outnumbered, was driven back about 50 miles between Faid Pass in the north and Gafsa in the south. Kasserine and Sbeitla were captured, and the enemy, advancing up the Kasserine Pass, threatened the important centers of Tebessa and Thala. This advance was serious, for it endangered some of the Allied forward airfields. By February 23, the advance of the Axis forces had been halted, however, and between February 26 and March 3 they were driven back to approximately their original positions. It had been a difficult period for the Allies, but General Eisenhower had demonstrated that he was a field commander of the first order.

Meanwhile, the British Eighth Army, after its victory at El Alamein, had made rapid progress. Tobruk was captured on Nov. 13, 1942; Benghazi, on November 20; Tripoli on Jan. 23, 1943; Mareth, on March 20; and Gabès, on March 29. On April 6, Wadi Akarit was attacked, and on the following day troops of the Eighth Army made contact with the Allies advancing in Tunisia. In mid-February, General Alexander had flown from Egypt to join General Eisenhower as his deputy. In that capacity he was charged with coordinating the action of the First and Eighth armies and of all Allied ground troops operating in North Africa—American, British, and French. Mid-April saw an extensive regrouping of Allied forces, including the transfer of several of the Eighth Army's best troops to the First Army, as it was considered that better and quicker results would be achieved if the final blow was struck in the north rather than in the south, where the country was more difficult and unsuitable for armor.

On May 1, the 120-mile Allied front ran roughly from Enfidaville northwestward to Pont-du-Fahs and then northward to the coast about 18 miles west of Bizerte. The British Eighth Army was on the right, French units on the right center, the British First Army on the left center, and the United States 2d Corps on the left in the coastal strip. The main attack, by the First Army and the 2d Corps, began on May 4, the British drive being directed on Tunis and the American drive on Bizerte. The assaulting troops were supported by a powerful force of aircraft, and the attack was preceded by a heavy artillery bombardment. Although the Axis troops fought with great determination, by May 6 the defense had cracked, and on the following day American and British troops entered Bizerte and Tunis, respectively. Confused fighting occurred from May 7 to May 12, but the British succeeded in clearing the Cape Bon Peninsula, where it had been thought that the Axis troops might make a last stand.

On May 13, all Axis forces laid down their arms in surrender. About 240,000 prisoners were taken, including 125,000 Germans. Col. Gen. Dietloff Jürgen von Arnim, the German commander in Tunis, was among those captured. Field Marshal Rommel escaped.

With the surrender of Axis forces in Tunis, no Germans or Italians remained in arms in Africa. From the time that Italy entered the war in June 1940, the number of Axis soldiers killed or captured in Africa totaled about 950,000. Approximately 2,400,000 gross tons of Axis shipping were sunk, and 8,000 aircraft were destroyed. In addition, 6,200 guns, 2,500 tanks, and 70,000 trucks were captured or destroyed. Allied shipping losses and British losses in army equipment in 1942 were also heavy and serious. Casualties in personnel, however, were only a fraction of those suffered by the Axis. Apart from the heavy Axis losses, the latter stages of the campaign in North Africa brought the Allies many advantages. Very soon the victory was to result in Italy's defection from the Axis partnership, and it paved the way for the reentry of the Allies to the European mainland. Moreover, the Tunisian campaign showed that American and British sailors, soldiers, and airmen could fight efficiently as one team, under one commander, against the common enemy.



**Map 33. EXPULSION OF THE AXIS POWERS FROM AFRICA (Feb. 14–May 13, 1943).** On Feb. 14, 1943, the Axis forces attacked the United States 2d Corps front in Tunisia, driving almost to the key towns of Tebessa and Thala. There the resistance of the Allies stiffened, and their subsequent counterattacks forced the Italo-German troops back to about their original positions. The British Eighth Army pushed Rommel northward and joined the Allied line on April 7. By May 1, the Axis forces had been penned into the northeastern tip of Tunisia. Under constant pressure, 240,000 troops (about half of them Germans) surrendered on May 13. Field Marshal Erwin Rommel himself escaped. All of Africa was now clear of Axis forces, and Sicily and the Italian mainland lay vulnerable to Allied attack.

#### CAMPAIGNS IN ITALY

**Conquest of Sicily: June–August 1943.**—Some weeks before the end of hostilities in North Africa detailed planning had begun for the capture of Sicily, to be followed by the invasion of the Italian mainland. On June 11, 1943, the island of Pantelleria, with its Italian garrison of 15,000 men, surrendered to the Allies, and the smaller islands of Lampedusa and Linosa surrendered on June 12 and 13, respectively.

The Allied forces in the Mediterranean were ready for the invasion of Sicily by early July. Under the supreme command of General Eisenhower, the land forces consisted of the Fifteenth Army Group under the direction of General Alexander, comprising the United States Seventh Army, commanded by Lt. Gen. (later Gen.) George S. Patton, Jr., and the British Eighth Army under General Montgomery. Axis forces in Sicily numbered about 75,000 Germans and 275,000 Italians. The German forces included the 15th Panzer Division with about 60 tanks and

the Hermann Goering Division with about 100 tanks. The Italians had four divisions and 100 light tanks.

The Allied troops taking part in the assault came from widespread areas: the American 1st and 3d divisions and the British 51st (Highland) Division from North African ports; the American 45th Division, from the United States; the Canadian 1st Division, from the United Kingdom; and the British 5th and 50th divisions and the 231st Infantry Brigade, from the Middle East. The Allied invasion fleet, comprising 3,000 ships and craft carrying about 140,000 men and covered by powerful naval and air forces, was approaching Sicily on the afternoon of July 9, when a severe storm blew up that threatened the landings with disaster. On the next morning, however, the assault took place as planned, the British Eighth Army landing in the southeastern corner of the island, and the United States Seventh Army on the south coast. The assault by sea was preceded by American airborne landings near Gela and by British landings near Syracuse (Siracusa). The first Allied airborne operations on a big scale, they were only partially successful because of the stormy weather. Many men and gliders landed at some distance from their targets, some of them falling in the sea. But the assault as a whole was successful, and Syracuse was captured that day.

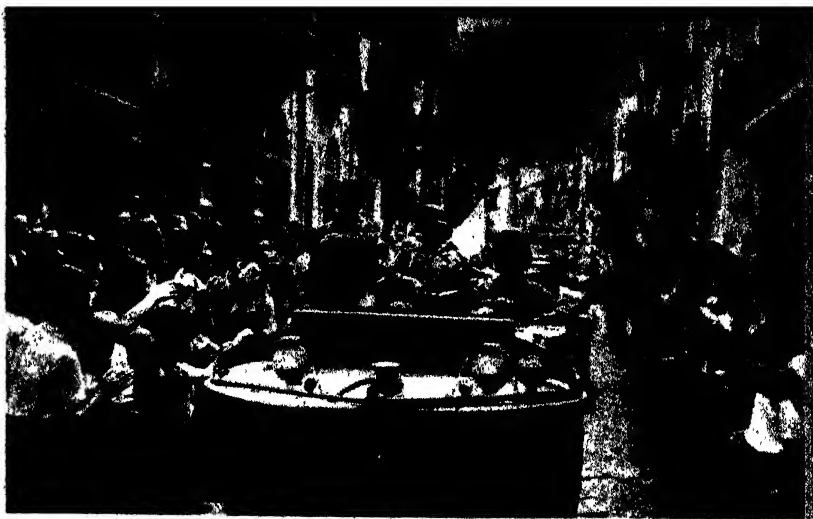
By July 22, British Commonwealth forces had advanced northward to the foothills of Mount Etna, while American troops had overrun the western part of the island, capturing Agrigento and Palermo. Only the northeast held out. By August 15, Randazzo and Taormina had been captured, and by August 17 all Axis resistance in Sicily had ceased. Allied casualties included 6,896 Americans and 12,843 British. Axis killed wounded, and prisoners numbered about 164,000 of whom approximately 32,000 were Germans. The Allies captured or destroyed about 1,500 aircraft, 78 armored fighting vehicles, 287 guns, and 3,500 motor vehicles.

While the fighting in Sicily was in progress, important political developments had been taking place. On July 25, Mussolini was forced to resign, and Marshal Pietro Badoglio became premier of Italy, while King Victor Emmanuel III assumed command of the Italian armed forces. These events were followed by secret feelers, put out by the Allies through neutral diplomatic circles, to induce Italy to cease hostilities and if possible declare war on Germany. On September 3, a military armistice between the Allies and the Italian government was signed secretly at Syracuse. It was announced publicly by General Eisenhower on September 8.

**Invasion of the Italian Mainland: September–October 1943.**—Immediately after the fighting in Sicily ended, planning began for the invasion of the Italian mainland. The general plan called for the British Eighth Army under General Montgomery to cross the Strait of Messina from Sicily onto the toe of Italy and advance northward as quickly as possible. About a week later the American Fifth Army under Lt. Gen. (later Gen.) Mark W. Clark was to land in strength on the west coast at Salerno, 30 miles southeast of Naples (Napoli) and 180 miles north of Montgomery's landing place, with the objects of joining its forces with the Eighth Army, cutting off substantial German forces in southern Italy, and capturing the port of Naples at an early date.

Sicilians cheer victorious American troops as they ride through the streets of Monreale on their way to Palermo, which surrendered on July 22, 1943.

Robert Capa-Magnum



Events moved quickly. On September 3, the Eighth Army, with massive sea and air support, crossed the Strait of Messina at Reggio di Calabria and advanced rapidly northward against light opposition. Eisenhower's announcement five days later of the capitulation of Italy regularized the withdrawal of the country from the war (which for all practical purposes had already taken place), but it did not as yet bring Italy into the conflict as a cobelligerent against Germany. The port and naval base of Taranto was occupied by British airborne forces on September 9. Two days later, the main part of the Italian Navy steamed into Valletta under escort, and Admiral Cunningham was able to signal the British Admiralty: "Be pleased to inform Their Lordships that the Italian battle fleet now lies at anchor under the guns of the fortress of Malta." During their voyage to Malta the Italian warships were heavily attacked by German aircraft. The flagship *Roma* was hit, caught fire, and blew up. Most of her crew, including the commander in chief, were lost.

The Fifth Army began landing at Salerno on September 9. For some days the Allied intelligence staff had known that Germans had replaced Italian troops in the Salerno area. There was some opposition on the beaches, but on the whole the landings went smoothly and without very heavy fighting. Although the Germans made furious counterattacks on the beachhead on September 13, the crisis was over by September 16, and on that day troops of the Fifth and Eighth armies linked forces. Troops of the Fifth Army occupied Naples on October 1, by which time the British 1st Airborne Division, which had landed at Taranto on September 9, had captured the important airfield at Foggia.

By October 12, the Allies had established a reasonably solid front across the Italian Peninsula, from Foggia on the Adriatic coast to just north of Naples on the west coast—a distance of about 120 miles. The Eighth Army was on the right, and the Fifth Army on the left. Success had been swift: within six weeks the Allies had captured and occupied a substantial part of Italy. There were, however, many hard battles still to be fought. Meanwhile, on September 19, the Italian island of Sardinia had fallen to the Allies, and on October 4 the French island of Corsica was taken.

**Strategic Considerations.**—The over-all policy, agreed to by the Allies for conducting the war, was that the main effort should be directed first

to the defeat of Germany, after which all available forces would be concentrated against Japan. There was, however, some difference of opinion between the American and British governments and their military advisers as to the best strategy for northwestern and southern Europe. The British at first favored exploiting the Mediterranean theater on the grounds that the Allies were already established there, that no further assault landings would be necessary, and that an attack on Germany through Italy and the Balkans would prevent the spread of communism in central Europe. The Americans held that a cross-Channel attack based on the United Kingdom was the easiest way of getting quickly to the heart of Germany and greatly simplified the logistic problem. They pointed out that while British Commonwealth forces received many of their reinforcements and much of their equipment and supplies through the Red Sea and the Suez Canal, the route from North America to the Mediterranean was longer, more dangerous, and logistically less convenient than that to the United Kingdom and the mainland of northwestern Europe. The American staff also drew attention to the formidable mountain ranges, very suitable

Driving north of Naples, British troops with the United States Fifth Army enter Capua, on the south bank of the Volturno River, on Oct. 7, 1943.

Imperial War Museum, London



for defense, which would have to be negotiated in an advance on Germany from southern Europe.

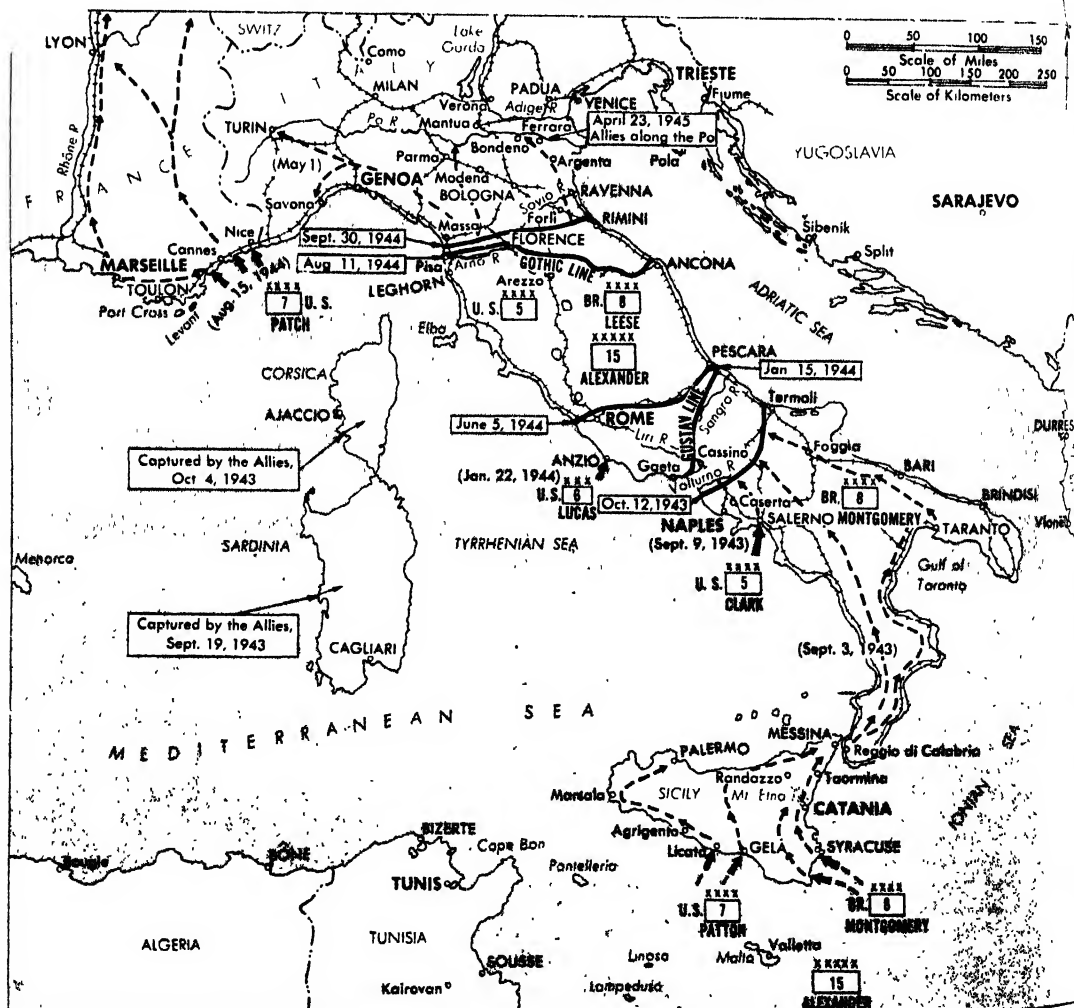
By the late summer of 1943 the American view had prevailed. Planning for Operation Overlord was in progress, and in consequence the Mediterranean theater tended to decrease in importance, although it was still to play a major part in Allied strategy. As soon as the Sicilian campaign was over, the Allies began to transfer 7 divisions (4 Americans and 3 British) from the Mediterranean to Britain in preparation for Overlord, which it was expected would take place in the late spring of 1944.

Following the conquest of Sicily and the surrender of Italy in September 1943, another important strategic matter arose. This was the question of occupying some of the islands of the Dodecanese, off the coast of Turkey, which were

mostly garrisoned by Italians. General Eisenhower was opposed to diverting troops from Italy for this purpose, but the Middle East command under General Wilson sent detachments, carried and escorted by British warships, to Leros and some smaller islands. While the Italian garrisons were friendly, they were not prepared to fight Germans in defense of the islands. Against heavy German threats the British garrisons were withdrawn by mid-November, and the Germans reoccupied the islands. British naval losses in these abortive operations comprised 6 destroyers and 2 submarines sunk by mines or German aircraft, and 4 cruisers and 4 destroyers damaged.

**Operations on the Italian Mainland: October 1943–August 1944.**—On Oct. 13, 1943, Italy declared war on Germany, and thereafter Italian partisan forces played an increasing role in the

**Map 34. CONQUEST OF SICILY AND THE ITALIAN MAINLAND (July 9, 1943–May 2, 1945).** After the capture of Tunisia, the Allies invaded Sicily as a steppingstone to Italy proper. Airborne landings were made late on July 9, and seaborne landings were made on July 10 as shown. By August 17, the island had been overrun, and a major portion of its garrison had been captured. Italy signed an armistice with the Allies in early September. At the same time, the American Fifth and British Eighth armies invaded the Italian mainland and advanced to a line above Naples. The two armies were to spend the rest of the war in the most depressing type of warfare—the attack of successive defensive positions across rivers and mountains. In the spring of 1945, the Allies finally broke through into the northern Italian plain. Thereafter the disintegration of the German forces was rapid; on April 29, they surrendered (effective May 2). The operations in Italy were costly to both sides, but they kept one third of Adolf Hitler's forces in western Europe pinned down and away from the decisive fronts.



war against their former Axis partner. By early November, the Allied land forces in Italy consisted of the American 3d, 34th, and 45th Infantry, 82d Airborne, and 1st Armored divisions and the British 46th, 56th Infantry, and 7th Armored divisions, of the Fifth Army; and the 5th, 78th, 1st Canadian, 8th Indian, 2d New Zealand, and 1st Airborne divisions, of the Eighth Army. About this time plans were made to transfer the French Corps under Gen. (later Marshal) Alphonse Pierre Juin from North Africa to Italy. Later the troops in Italy were to be joined by the Polish Corps under Gen. Władysław Anders and by other American, British, and Canadian formations.

The winter of 1943–1944 was a period of hard fighting which brought the Allies up to the German Gustav Line. The Fifth Army crossed the Volturno River on October 13. On November 8, General Alexander issued a directive for offensives by the Fifth and Eighth armies. The Eighth Army began its offensive on the Sangro River on November 20, and the Fifth Army attacked in the Liri Valley on December 1. In both cases the advance was limited, as neither army was strong enough to exploit its success.

In January 1944, there were important changes in command. General Eisenhower left the Mediterranean theater to direct Overlord and become supreme commander of the Allied Expeditionary Force in northwestern Europe. He was succeeded as supreme commander in the central Mediterranean by General Wilson. General Alexander remained as commander in chief in Italy. General Montgomery, who returned to the United Kingdom to command the Twenty-first Army Group, was succeeded by Lt. Gen. Sir Oliver Leese in command of the Eighth Army.

As early as October 1943, plans for an amphibious Allied landing near Anzio had been considered. As finally approved, the landing was to be made by the United States 6th Corps under Maj. Gen. John P. Lucas, comprising 1 United States infantry division, a United States armored element, a battalion of Rangers, a parachute regimental combat team, and 1 British infantry division, a British armored element, and 2 Commando units. The object of the landing was to cut the communications of the German 14th Corps, assist the main Allied armies to advance to the north, and capture Rome (Roma). The landing took place on Jan. 22, 1944. The leading troops advanced about 10 miles but were then halted by stubborn resistance. The German commander, Field Marshal Albert Kesselring, concentrated 10 German divisions against the 4 which, with further reinforcements, the Allies had established on the beachhead. While the Anzio beachhead held firm, little progress was made by the Allies on any front, and it was nearly five months before Rome was captured.

At the end of March 1944, the Allied position facing the Gustav Line extended for 100 miles westward across Italy, from the Sangro River to Cassino and thence to the Tyrrhenian Sea near the mouth of the Garigliano (lower Liri) River. The Anzio beachhead was firmly held. The key position in the Gustav Line was Monte Cassino with its famous Benedictine abbey on the summit. This position was attacked first by the United States 2d Corps (the 34th and 36th divisions) in January; then by the New Zealand 2d Corps (the New Zealand 2d, Indian 4th, and British 78th divisions and a combat group of the United States

1st Armored Division) in February; and for a third time, again by the New Zealand 2d and Indian 4th divisions, in March. All three attacks failed despite the fact that the last two were preceded by massive bombardments by heavy bomber aircraft as well as by artillery. The Allies spent the month of April and first half of May regrouping and planning for a further assault on the Gustav Line at Cassino, preparatory to an advance on Rome. By this time the strategy in the Mediterranean had definitely become subordinate to northwestern Europe, where the cross-Channel assault was planned for early June. General Alexander defined the task of the forces in Italy as follows: "To force the enemy to commit a maximum number of divisions in Italy at the time the Cross-Channel invasion is launched."

The fourth and last assault on the Cassino position was carried out by the Polish Corps, with the British 2d Corps on its left ready to advance up Highway 6 in the Liri Valley and open the road to Rome. Farther to the left the Fifth Army (which included the French Corps) was to advance on Rome, using Highway 7 as its main axis. The offensive was supported by 1,000 guns with the Eighth Army and 600 with the Fifth Army and by more than 3,000 aircraft. The battle began on May 11, but it was not until the morning of May 18 that the Poles were able to occupy the abbey of Monte Cassino. The whole Allied battlefront westward from Cassino then surged forward, and events moved rapidly. On May 23, the Allied forces in the Anzio beachhead took the offensive and joined the troops of the Fifth Army advancing from the south. By this time the Germans had decided to give up the Gustav Line, and their next position, the Hitler Line, was already pierced. On June 4, American troops of the Fifth Army entered Rome, which the Germans had declared to be an open city. The bridges were left intact, and the city was saved many of the ravages of 20th century warfare. Two days later, on June 6, the forces in Italy learned of the successful Allied landings on the Normandy coast.

After the capture of Rome the Allies pressed northward on what was in reality two fronts divided by the Apennines and with only slight ground contact over the mountain barrier. One portion of the Eighth Army was to the east of the Apennines; the Fifth Army and the rest of the Eighth Army, to the west. The full exploitation of success was prevented by the withdrawal of more troops from Italy to help the Allies in northwestern Europe by means of landings in southern France. Pescara on the Adriatic was captured on June 11, Arezzo on July 16, Ancona on July 18, Leghorn (Livorno) on July 19, and Florence (Firenze) on August 11. The Allies now faced the German Gothic Line, which ran from the Adriatic to the north of Ancona, north of Arezzo and Florence, to the west coast north of Leghorn, or about 150 miles.

**Allied Landings in Southern France: August–September 1944.**—At the Teheran Conference (Nov. 28–Dec. 1, 1943) it had been agreed that the landings in northwestern Europe would be followed by further landings in the south of France. After the fall of Rome preparations began to implement this decision at the expense of General Alexander's forces in Italy. It was now proposed to withdraw 7 good divisions from the Fifth Army: 3 American (the 3d, 36th, and 45th) and 4 French. Known at first as Anvil, the operation was later code named Dragoon. Planning and



execution were entrusted to the headquarters of the United States Seventh Army under Maj. Gen. (later Lt. Gen.) Alexander M. Patch. The troops consisted of the United States 6th Corps, commanded by Maj. Gen. (later Lt. Gen.) Lucian K. Truscott and composed of 3 United States divisions; and the French 2d Corps, composed of divisions formerly in Italy, under Gen. Jean de Lattre de Tassigny.

Early on the morning of Aug. 15, 1944, a special service force of American and Canadian units seized the offshore islands of Levant and Port-Cros, while French Commando troops landed on the French Riviera mainland immediately to the north. Farther inland and 22 miles west of Cannes, the 1st Airborne Task Force, consisting of American and British airborne units, was dropped. These preliminary operations were quickly followed by seaborne landings of major formations of the Seventh Army between Nice and Toulon. German resistance was not sustained, but it was tenacious in places, especially at Toulon and Marseille. By August 27, the French had captured Toulon, and on the following day, Marseille. After liberating southern France the Allied force moved via the Rhone and Doubs valleys to the Belfort gap. It then joined with the Allied armies in northwestern Europe, came under General Eisenhower's command, and ceased to be within the Mediterranean theater of operations.

For a more detailed account of operations in southern France in 1944, see section 5. *Recovery of France and Advance into Germany.*

**Campaign in Italy: August 1944–May 1945.**—Despite the weakening of his forces, General Alexander made early plans for an assault on the Gothic Line. This involved the transfer of troops from the western or left flank to the right flank in preparation for an attack on the enemy's left. The offensive was opened by the Eighth Army on Aug. 25, 1944, and by August 31 the German front had been pierced on a line 20 miles long to a depth of 4 miles. On the left the Fifth Army, which included some British Commonwealth formations, also attacked vigorously, and by September 13 had broken the enemy front north of Florence. Rimini fell to the Allies on September 21, and by September 28 the Gothic Line had been forced. This phase of the Italian campaign was an exceptionally fine operation by the Allies, carried out despite dwindling numbers in difficult mountain country well suited to defense. The price, however, was a heavy one—approximately 50,000 casualties. When the offensive was halted at the end of September, the line ran across Italy from east to west for about 150 miles, from north of Rimini to north of Florence and Pisa.

There followed a lull of about six weeks, but elsewhere in the Mediterranean theater an important development took place. In the late summer of 1944 it became apparent that the Germans were preparing to withdraw from Greece. The country was in ruins, however, and clearly the first requirement was an Allied force to maintain law and order, prevent the country from falling under Communist domination, carry out relief work, and generally reestablish stable conditions. Operation Manna, the code name for the relief force, was ready by mid-September, its commander being the British Lt. Gen. (later Sir) Ronald M. Scobie. Except for some Greek units, which had been operating under Allied command in Italy, the force was mostly British, including initially the 2d Parachute Brigade, 23d Armored Brigade (in an

infantry role), and administrative units. The land forces were to be supported by the 15th Cruiser Squadron, United States transport aircraft, and four British and three Greek air squadrons.

On September 26, a conference took place at Allied headquarters at Caserta, Italy, which was attended by representatives of Premier George Papandreou's Greek government in exile and leaders of the two principal Greek partisan groups, the National Liberation Front (EAM) and the Greek People's Army of Liberation (ELAS). The latter both agreed to operate under General Scobie's orders. On October 3, British Commando and airborne troops landed in southern Greece and on the next day occupied Patras (Patrai). Additional airborne forces landed at Megara Airfield, outside Athens, on October 13, and on the following day moved into the capital on the heels of the retreating Germans. Naval forces immediately entered Piraeus (Peiraeus), bringing General Scobie and the rest of his force, followed two days later by the Greek government.

By November 8, the last formed bodies of German troops had left Greece, but their departure did not bring peace. The rival partisan groups—the left-wing EAM and ELAS and the anti-Communist EDES (National Greek Democratic League)—were openly hostile to the Greek government, and in addition quarreled and fought among themselves. The partisans' promise to take orders from General Scobie was soon broken. Toward the end of November, Scobie's command was reinforced by the Indian 4th Division. The last days of November and early December saw a bid by ELAS to take over Athens, and clashes between British troops and ELAS occurred in the city on December 5. In the face of increasing partisan opposition some of the smaller British detachments had to be withdrawn, a few suffering casualties in the process.

With the situation worsening, the Greek government and the Allies turned to Archbishop Damaskinos as the leading figure in Greece and the man with the greatest influence over all parties. As a result of a meeting held on December 26–27, attended by the archbishop, Prime Minister Churchill, and other political and military leaders, King George II of Greece postponed his return to the country, the archbishop became regent, and Papandreou was replaced as premier by Gen. Nicholas Plastiras. In the meantime, General Scobie had been further reinforced by the British 4th Division, which was intercepted in mid-December, while on route from Italy to Egypt. Its arrival turned the scale, and by Jan. 5, 1945, Athens and Piraeus had been cleared of dissentient forces.

On February 12, representatives of the Greek government and the Central Committee of EAM-ELAS signed at Varkiza an agreement, the terms of which included the disarming and demobilization of all revolutionary forces (who were to release their hostages), a general amnesty, and the formation of a national army. Following the Varkiza agreement, British forces had little difficulty in occupying all of Greece. The worst was over and the troubles of the Greeks gave way to more urgent matters.

Meanwhile, in Italy on Nov. 3, 1944, Lt. Gen. (later Gen.) Sir Richard L. McCroery succeeded General Leese in command of the Eighth Army. During the late fall and winter the battlefront remained generally inactive, but the Allies made some progress on their right along the Adriatic

coast. Forlì was captured on November 10, and Ravenna on December 5. Operations were greatly hampered by unusually heavy rainfall during the last three months of the year. On the night of October 1, for example, approximately 8.5 inches of rain fell in the Po Valley in 10 hours, reducing the countryside to a quagmire.

On December 12, General Wilson left the Mediterranean theater to become head of the British Combined Services Mission in Washington. His place as supreme Allied commander in the Mediterranean was taken by the recently promoted Field Marshal Alexander. General Clark became commander of the Allied armies in Italy, which now reverted to the title of Fifteenth Army Group, and General Truscott took command of the Fifth Army. Between Dec. 28, 1944, and Jan. 2, 1945, the Germans made a powerful counter-attack against the Allied left in the Serchio Valley north of Pisa. It fell mainly on the Indian 8th Division, which stood firm and repulsed the attack with heavy losses to the Germans.

In mid-March, Allied intelligence staffs estimated that about a third of the German strength in the west was employed in Italy, and this was judged to be an important factor in the success of Overlord. Special measures were taken to make this known to the Allied troops in Italy, and it proved a useful antidote to the disappointment caused by the earlier withdrawal of troops, which had prevented the Allies from completing the conquest of northern Italy. By the early spring, Italian troops were playing a considerable role in operations against their former German partners. Their activities were mostly of the guerrilla type, but they also had some field units in action.

On April 9, German strength in Italy was the equivalent of 26 divisions, including 1 panzer and 1 light (motorized) division. On this day the Eighth Army on the right launched a major offensive, supported by heavy air and artillery bombardments, and crossed the Senio River. On the Allied left the Fifth Army also carried out a heavy attack, capturing Massa and crossing the Fugido River. On April 16, Field Marshal Alexander and General Clark made it known that the hour for the final battle for Italy had arrived. On the Adriatic side the offensive of the Eighth Army had been designed in the initial stages to give an opportunity to exploit success, either through the Argenta gap near the coast or farther west through Bologna. Argenta was the choice; on April 17 the gap was secured, and the town itself was entered the next day. Meanwhile, the Fifth Army offensive, which had begun on April 14, met with stubborn resistance in the mountains, but once the battlefield reached open country the German withdrawal became a rout.

On both fronts the retreating enemy was pursued by Allied armor and pounded by Allied aircraft. The object of the Germans was to get as many troops and as much equipment as possible north of the Po River. Bologna fell to the Fifth Army on April 21, and on April 23 leading armored elements of the Fifth and Eighth armies met south of the Po in the Ferrara-Finale nell'Emilia area, where they created havoc among German troops and transport crowding the roads to reach the river bridges. By that evening the Fifth and Eighth armies had reached the Po on a wide front. Ferrara, Bondeno, and Modena (all south of the Po) fell on April 24, and by the evening of April 25 approximately 30,000 German

prisoners were in Allied hands, and a substantial part of the German armor, artillery, and transport had been destroyed or captured. Such was the measure of the defeat of the Germans south of the Po that they were unable to offer any serious resistance on this formidable river line, which the Allies crossed without serious opposition.

Operations now entered the area of Napoleon's Italian campaigns, and familiar names appeared on the air and in written messages. On April 26, Mantua (Mantova) and Verona fell, and the Adige River was crossed. At this stage it was revealed that the area west of the Como-Milan (Milano)-Genoa (Genova) line was virtually under the control of Italian resistance troops, who had been organized by Allied liaison officers and equipped from Allied sources. Genoa was occupied by the Fifth Army on April 27. On the following day, Mussolini was murdered by partisans. By this time the Fifteenth Army Group was firmly established across the Adige, and on April 29 it began advancing northward from the river. On the same day the Fifth Army entered Milan, and the Eighth entered Padua (Padova). On April 30, the official communiqué stated: "Troops of the Fifteenth Army Group have so smashed German Armies in Italy that they have been eliminated as a military force." About 120,000 Germans had been taken prisoner since the offensive started.

On the last day of April, purely military operations began to give way to other considerations. It was important that northeastern Italy should be occupied as quickly as possible by American and British troops. Large numbers of German soldiers, many of them detached from their units and not under regular discipline, were roaming the countryside. Many thousands of Italian partisans were to be found, not all of them under proper control. A dispute between Yugoslav partisans and Italians over the possession of Trieste seemed likely to cause a clash, and for many reasons it was desirable that Austria should be occupied as soon as possible. Although the fighting was nearly over, there was much to be done to preserve law and order and bring about a semblance of control.

Allied troops entered Savona and Turin (Torino) on May 1. On the following day, May 2, 1945, at 12 noon, hostilities in Italy came to an end as the result of an instrument of unconditional surrender signed at Caserta on April 29 by representatives of Col. Gen. Heinrich von Vietinghoff-Scheel, commander in chief of the German Southwest Army Group. Nearly 1,000,000 Germans then laid down their arms. Thus ended operations in the Mediterranean theater of war, which had begun on land on the Egyptian-Libyan frontier early on June 11, 1940, a few hours after Italy entered the war.

The purpose of the Allied campaign in Italy was to contain as many Axis troops as possible in order to ease the burden on other fronts. The extent to which this objective was accomplished can be judged by the following comparison of German and Allied strengths at various times (Italian units, which at different times formed part of the forces of both sides, are not included):

	Germans	Allies
Mid-October 1943.	19 divisions	15 divisions
Spring 1944 <sup>1</sup>	23 divisions	27 divisions
Summer 1944	25 divisions	20 divisions
Mid-March 1945	24 divisions	17 divisions and 9 independent brigades

<sup>1</sup> For a brief period only.



Occidental powers. Now the crisis was at hand.

**Road to War.**—The stringent economic restrictions put into effect by the United States in 1940–1941 made it impossible for Japan to import the raw materials required for war production. She now faced the alternatives of either abandoning her ambitions for empire or making herself self-sufficient through the seizure of the Southern Regions. The former course was unthinkable, while the latter seemed a simple venture under existing circumstances. The British, American, and Netherlands forces confronting Japan were weak. The possibility of British and Dutch reinforcements arriving in strength in Asia or the East Indies was remote, for the Netherlands was in German hands and the British were struggling for survival in the Middle East. Even the USSR was reeling under German attacks. The United States was far from being mobilized and was committed through its lend-lease program to the support of the nations aligned against Germany and Italy.

Certainly the time was ripe for Japan to act with vigor and celerity if her dreams of empire were to be realized. Several years would be required for the United States and Great Britain to muster their full strength in the Pacific, years during which Japan could seize and develop the resources of the Far East and make herself impregnable against counterattack. Four years of campaigning in China had inured her soldiers to the rigors of war. Guns, tanks, planes, and other equipment had been tested in combat. In the many amphibious operations against Chinese ports the Japanese had developed skill in the type of war which they would encounter and had mastered the close coordination of land, sea, and air power.

By Dec. 7, 1941, the Japanese Army had grown to a force of 2,400,000 trained men and 3,000,000 partially trained Reserves. The air fleet consisted of 7,500 planes (including 2,675 first-line planes), which were divided about equally between the army and the navy. The rate of new plane construction was 425 monthly, and additional pilots were being trained at a rate of 2,750 a year. Dissatisfied with the lesser role assigned her by the other powers, Japan in 1934 had denounced the naval agreements of 1922 and 1930, and had secretly increased the strength of her navy to 230 major vessels.

West of Hawaii the Allies could oppose this formidable Japanese war machine with approximately 350,000 poorly equipped ground troops, about 90 warships, and less than 1,000 planes, most of which were obsolete. This force, largely untrained and inexperienced and composed of a mixture of nationalities with divergent customs, languages, and interests, was scattered across the Pacific and Southeast Asia from Wake Island to Burma and from Hong Kong to Australia. The principal centers of Allied strength in the Far East were located in Malaya and the Philippines.

The strength of the Japanese armed forces was enhanced by their strategic disposition. The mandated islands in the Central Pacific, which had been secretly fortified, provided excellent bases for operations to the east against Hawaii, to the west against the Philippines, and to the south against New Guinea, the Solomon Islands, and Australia. American Guam and Wake Island were unfortified and could be taken easily. Bases on the China coast and airfields on Taiwan (Formosa), the Ryukyu Islands, and the home islands provided a safe channel for Japanese ship move-

ments southward. The Japanese occupation of southern French Indochina in July 1941 furnished bases for easy access to Malaya and the key British naval base at Singapore. The Philippines, the principal American outpost in the Far East, were hemmed in on three sides by bases in the Palau group, Taiwan, Hainan, Spratly Island, and French Indochina. Hong Kong, which with Singapore and Manila constituted the foundation of Anglo-Saxon power and influence in the Far East, was isolated by a strong cordon of Japanese troops and by bases on Taiwan and Hainan.

The scene for the drive to the south had been well set, but Japan had her Achilles' heel—her merchant marine, which had grown to 6,100,000 tons. An industrial island nation like Great Britain, she needed to import large quantities of unprocessed materials for home consumption and for the manufacture of war goods; and support of the contemplated military operations would double the burden. Japan could fulfill her shipping requirements as long as undue losses were not experienced, but there was no margin of safety. The ravaging of Japan's merchant marine by American aircraft, submarines, and surface warships was to prove a decisive factor in her eventual defeat.

By December 1941, the United States Army had reached a strength of about 1,500,000 men, of whom 1,000,000 were not completely trained. The Army Air Forces had 1,157 first-line combat aircraft, of which 159 were four-engine bombers. The Navy consisted of 347 warships, and an ambitious expansion program was on the ways. American merchant shipping aggregated more than 10,000,000 tons and was growing rapidly. Nevertheless, the state of American preparedness was gravely affected by the commitment of a large portion of war production to the conflict in Europe.

**Japanese War Plan.**—As the time for war approached, the military hierarchy dominated Japan economically and politically as well as militarily. The basic war plan of Imperial General Headquarters was divided into three phases. Phase 1 included neutralization of the United States Pacific Fleet at Pearl Harbor, seizure of the Southern Regions, and establishment of a defensive perimeter to protect these regions and the Japanese homeland. Phase 2 consisted of the consolidation and strengthening of the perimeter with a string of fortified bases extending from the Kuril Islands through Wake Island, the Marshall and Gilbert Islands, the Bismarck Archipelago, northern New Guinea, Timor, Java, Sumatra, Malaya, and Borneo. Phase 3 embraced the interception and destruction of any attacking forces that might attempt to penetrate the defensive perimeter, and the waging of a war of attrition to destroy the will to fight of the United States, the principal antagonist.

With her western flank protected by the occupation of the China coast and her northern flank by the neutralization of the USSR through a non-aggression pact, Japan could apply maximum pressure toward the south and east. The only real threat to the Japanese war plan was the United States Pacific Fleet based at Pearl Harbor. The first operation would therefore be the neutralization of this fleet by means of a surprise air attack. The First Air Fleet, a strategically mobile striking force built around 6 fast aircraft carriers, was assigned this task. Once the strike at Pearl Harbor had been successfully completed, strong air

attacks, preliminary to invasion, were to be launched against the Philippines and Malaya to destroy the principal Allied concentrations of air-power in the Far East. Air blows would also be struck against Hong Kong, Wake, and Guam.

The main Japanese attack was to be the drive to seize the Southern Regions. The offensive would begin with a two-pronged thrust, one prong being directed against Malaya and the other against the Philippines. At the same time, Guam, Wake, Hong Kong, British Borneo, and Thailand were to be occupied; and advance bases were to be established in the Bismarck Archipelago, Netherlands Borneo (Kalimantan), Celebes, the Moluccas, and Timor. After the capture of Malaya and the Philippines, the two main forces were to be combined for the invasion of Java, the heart of the Netherlands East Indies. By then the First Air Fleet would have completed its operations in the Central Pacific and could lend its overwhelming power to the assault. At an opportune time, large-scale operations would be undertaken in Burma with the primary object of cutting the Burma Road. Upon the successful completion of these campaigns, the first-phase objectives would have been attained. The second and third phases would follow, and Japan would then revert to the strategic defensive, prepared to counter the eventual assaults of the United States and Great Britain.

This plan for the simultaneous conduct of many far-flung operations violated the cardinal military principle of concentrated application of combat power, but in view of Allied weakness such an unorthodox strategy was sound. Striking everywhere at once not only would exploit the essential element of surprise, but would place the Allies on the defensive on all fronts and confuse them as to the true Japanese objectives. It would take advantage also of the Allies' divergent self-interests and thus hinder any attempt to combine and concentrate available defensive forces during the first phase. The military leaders were confident that once Japan dominated the entire Far East, the Allies, operating at the end of long supply lines and lacking well-developed advance bases, would find reconquest a difficult and prolonged, if not impossible, task.

#### JAPANESE OFFENSIVES

Early on Sunday morning, Dec. 7, 1941, the First Air Fleet surprised the bulk of the United States Pacific Fleet at anchor in Pearl Harbor and inflicted such damage as to put it out of action as an effective major force for some time. Simultaneously, 2 destroyers attacked the American base at Midway and withdrew after severely damaging its air installations. On December 8, Japanese bombers began to rain destruction on the American garrison of Wake Island. An attempt to land on December 11 was beaten off, but the exhausted garrison succumbed to an overwhelming assault on December 23. From bases on the secretly fortified nearby islands of Rota and Saipan, Japanese aircraft bombed Guam. The small American garrison on the unfortified island was overwhelmed by Japanese troops on December 10. During the month the Japanese also occupied Tarawa and Makin atolls in the Gilbert Islands.

The Japanese attack on Hong Kong came early on December 8 (local time). The British garrison held out until Christmas Day, when, exhausted and without possibility of outside aid, it

surrendered. Simultaneously, Japanese troops moved from their bases in French Indochina to overrun Thailand and advance into Burma, and an amphibious force landed on the east coast of the Kra Peninsula and moved southward into Malaya. On Feb. 15, 1942, Singapore, symbol of British strength in the Far East, fell. By May 20, the Allies had been virtually driven from Burma into India, the Burma Road had been cut, and Southeast Asia was in Japanese hands. The western prong of the offensive had done its work well.

**Fall of the Philippines.**—The Tydings-McDuffie (Philippines Independence) Act, passed by the United States Congress in 1934, provided for the complete independence of the Philippines after a 10-year period as a commonwealth. Independence was scheduled for July 1946. The fact that the United States intended to withdraw from the islands deterred it from any sizable augmentation of the defensive installations. To assist the Philippines Commonwealth in preparing its own defenses, the United States in 1935 sent Gen. (later General of the Army) Douglas MacArthur to serve as military adviser to the new government. An ambitious program for national defense was initiated in 1936, but it was not far advanced when the Japanese struck in 1941. Japanese encroachments in the years preceding the war had almost surrounded the Philippine Islands. The only line of communication that did not pass through Japanese-controlled waters was to the south, toward the East Indies.

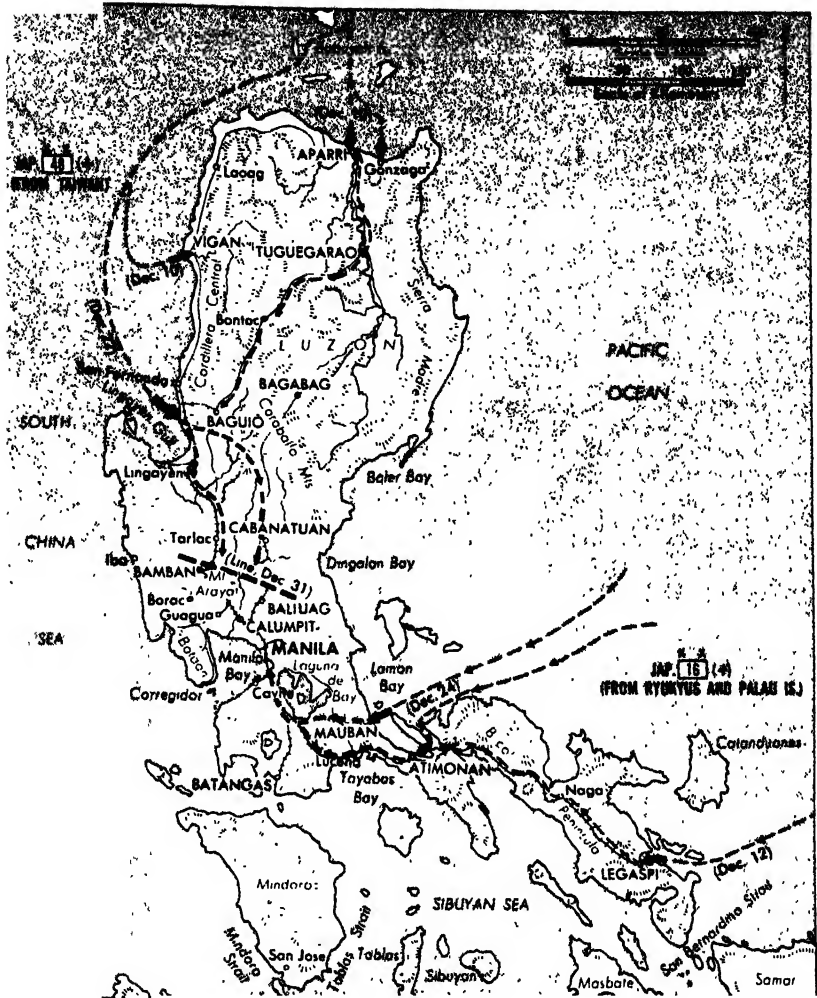
On July 26, 1941, the United States, alarmed by Japan's threatening attitude in the Far East, ordered the embryonic Philippine Army into the service of the Army of the United States, as provided in the Tydings-McDuffie Act. A new headquarters, known as the United States Army Forces in the Far East (USAFEF), was created, with General MacArthur in command. The Regular component of the Philippine Army was inducted immediately, and mobilization of 10 Reserve divisions began. National Guard tank and antiaircraft units were sent from the United States, and in November the 4th Marine Regiment was transferred from Shanghai, China.

By December, Allied ground forces in the Philippines totaled about 130,000 men, 100,000 of whom were hastily mobilized Philippine Army troops lacking training and inadequately equipped. American personnel numbered only 13,507 men, who for the most part were assigned to the 31st Infantry Regiment, and various antiaircraft, armored, and harbor defense units. Other troops consisted of 12,000 dependable Philippine Scouts and 3,000 members of the Philippine Constabulary. The United States Far East Air Force, under the command of Maj. Gen. (later Lt. Gen.) Lewis H. Brereton, comprised 277 aircraft (only 142 of which were suitable for combat) and 5,609 aviation personnel. United States naval strength in the Philippines area consisted of 1 heavy cruiser, 1 light cruiser, 4 destroyers, 28 submarines, 6 gunboats, 28 aircraft, and miscellaneous vessels. This was the major portion of the United States Asiatic Fleet, commanded by Adm. Thomas C. Hart. By this time, approximately 500,000 tons of additional supplies and 20,000 troop reinforcements had been earmarked for dispatch to the Philippines, but the Japanese struck before the first shipments could arrive.

The configuration of the Philippine Archipelago makes it very difficult to defend in its entirety. It comprises about 7,100 islands and islets extend-



Map 36. INVASION OF THE PHILIPPINES (Dec. 10, 1941-Jan. 7, 1942). The initial Japanese landings on Luzon were made at the northern and southern extremities of the island. The object was to draw the defenders to these areas so that, when the main landings were made at Lingayen Gulf and Lamon Bay in central Luzon, Gen. Douglas MacArthur's forces would be separated in isolated areas and subject to easy destruction. This strategy did not deceive MacArthur; he kept his forces closely under control and gradually conducted an orderly withdrawal toward Bataan Peninsula in accordance with the basic war plan.



ing approximately 1,100 miles from north to south and 700 miles from east to west. The problem of defense resolved itself into an effort to hold only the largest and most important land areas, particularly Luzon and Mindanao.

A fundamental weakness of the Philippines was its dependence on the outside world. Though possessing rich natural resources, it lacked heavy industries and munition plants and had only a few factories capable of supplying even the smallest items of military equipment. Gasoline and oil had to be imported. Once cut off from outside assistance, the defenders of the islands could not long endure.

**Capture of Luzon.**—General MacArthur's plan was to make his principal defense on Luzon, the largest and most important island of the group. All but three Philippine Reserve divisions and some miscellaneous troops were concentrated there. Except for 16 heavy bombers and a squadron of Navy patrol bombers, which were in Mindanao, the entire air force was also based on Luzon. A war warning had been received on November 27, and because of the lack of air protection Admiral Hart had moved most of the warships of the Asiatic Fleet out of Manila Bay.

For the defense of Luzon, MacArthur had organized three field forces: the North Luzon Force, the major defense unit, consisting of three Philip-

pine Reserve divisions and elements of the Philippine Scouts, which was under the command of Maj. Gen. (later Gen.) Jonathan M. Wainwright; the South Luzon Force, composed of two Philippine Reserve divisions, elements of the Philippine 1st Regular Division, and two regiments of the Constabulary, commanded by Brig. Gen. (Later Maj. Gen.) George M. Parker, Jr.; and the USAFFE reserve, which was retained directly under MacArthur's command and included the Philippine Division, two Philippine Reserve divisions, two American tank battalions, and miscellaneous other units. The nucleus of the entire force defending Luzon was the Philippine Division. It included two first-rate Philippine Scout infantry regiments, the American 31st Infantry Regiment, and a full quota of division artillery. Two other forces had also been formed: the Philippine Coast Artillery Command, comprising all coast and antiaircraft artillery, which was charged primarily with the defense of Manila and Subic bays; and the Visayan-Mindanao Force, which was responsible for the defense of the southern islands. The plan of defense was to fight as strong a delaying action as possible, retiring as it became necessary to the Bataan Peninsula and the forts of Manila Bay, where a final stand would be made until the United States Navy brought aid.

The Japanese Fourteenth Army, commanded by Lt. Gen. Masaharu Homma and consisting of two reinforced divisions, the 16th and the 48th, was assigned to the invasion of the Philippines. These divisions were well trained and had had fighting experience in China. Each comprised almost 50,000 men and as many as 100 tanks. The 48th Division was to land in northern Luzon and the 16th in southern Luzon; both were to converge on Manila. Meanwhile, elements of the 16th Division would invade Mindanao. The bulk of the Japanese Third Fleet—5 cruisers, 14 destroyers, 1 seaplane carrier, and a host of auxiliaries—was designated the Northern Philippine Force and assigned to support the attack on northern Luzon. The Southern Philippine Force, consisting of the rest of the Third Fleet plus a carrier division—2 aircraft carriers, 5 cruisers, 13 destroyers, 2 seaplane carriers, and a large number of transports and supply ships—was assigned to support the landings in southern Luzon and in the Mindanao-Sulu Archipelago area. Once the landings in Malaya had been successfully carried out, the roving Japanese Second Fleet—2 battleships, 3 cruisers, and 4 destroyers—would provide added support for the main landing on northern Luzon.

The first task of the Japanese was to destroy American airpower and air installations and to seize airfields for land-based aircraft. Since army aircraft based on Taiwan could barely reach Luzon, navy planes had to be used for the main strikes until airfields in the Philippines had been captured. The plan was to strike at dawn on December 8 with a force of 84 fighters and 107 bombers, but a heavy fog blanketed the fields on Taiwan that morning, and the first aircraft did not leave until 10:15 A.M. The Japanese aircraft appeared over Luzon shortly after noon. The delay in attacking proved fortuitous for Japan. Since MacArthur had been informed at 3:30 A.M. that a state of war existed, his planes were in the air at dawn seeking the enemy, and a number of false alerts kept them busy for most of the morning. When the Japanese planes arrived, many of the American fighters were in the process of landing for refueling, others were grounded at airfields because of dust, and the bombers were on the ground. The Japanese therefore encountered little resistance and proceeded to wreak havoc on the American aircraft and installations. The airfields on Luzon were virtually put out of action, and the naval base at Cavite was destroyed. By the end of the day half of the American bomber force and a third of the fighters had been destroyed. Possessing mastery of the air, the Japanese continued their destructive attacks during the succeeding days. The 16 remaining American bombers were withdrawn on December 11 to Mindanao, and then to Australia, without having been able to mount a single effective strike. By December 15, American fighters had been reduced to a handful, and these were now husbanded for reconnaissance purposes.

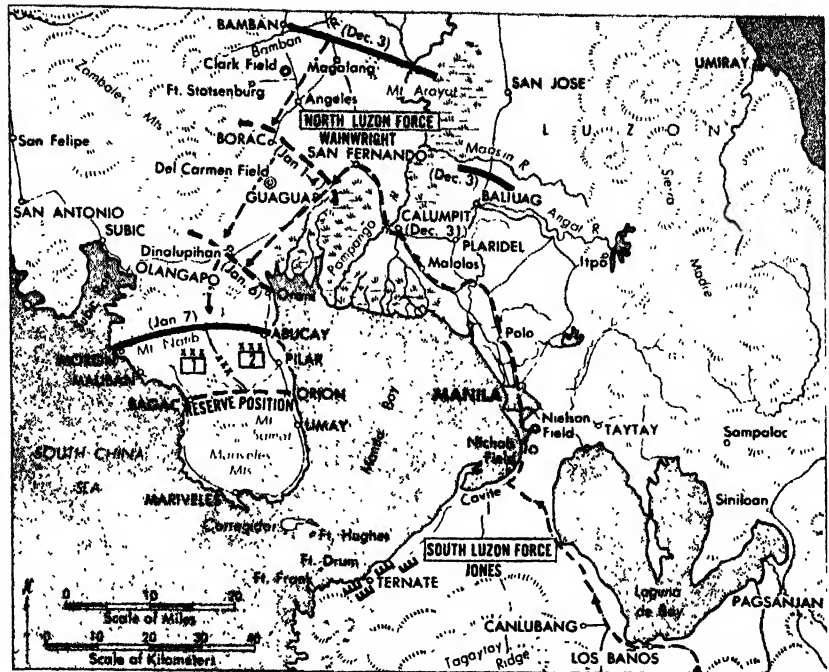
At dawn on December 10, the first Japanese landings took place at Aparri and Vigan in northern Luzon. Elements of the 48th Division, consisting of about 2,000 men each, went ashore at the two points. Early on December 12, 2,500 men of the 16th Division landed at Legaspi in southern Luzon. These landings were designed to lure the defenders to the extremities of the island so that, when the main forces debarked in central Luzon, MacArthur's forces would be divided and

isolated. The general did not succumb to this strategy. Instead, he allowed the small forces in the areas concerned to delay the Japanese as best they could; attacked the Japanese naval forces supporting the landings with his meager air force, though with negligible results; and held his troops close in hand, awaiting the main landings. These came at Lingayen Gulf early on December 22 and at Lamon Bay before dawn on December 24.

Initially, MacArthur's plan had been to meet the Japanese at the beaches and drive them back into the sea. Since this was obviously impossible with the limited combat strength available, his troops had been ordered to hold certain lines inshore and delay the enemy. Thus, when the bulk of the 48th Division (43,110 men and from 80 to 100 tanks) landed at Lingayen Gulf, it encountered little opposition. General Wainwright's North Luzon Force braced itself to meet the inevitable onslaught. The Regular units fought well and offered stiff resistance, but the inexperienced Philippine Reserve divisions were no match for the battle-hardened Japanese troops. Constantly threatened with outflanking on the east, the North Luzon Force gradually gave ground. On December 31, Wainwright's troops were holding desperately to the Bamban-Mount Arayat line and at Baliuag in order to keep open the only escape route into the Bataan Peninsula for the South Luzon Force. This force, which was threatened with outflanking on the south on the very first day, had been falling back toward Manila. On December 24, MacArthur ordered General Parker to prepare the defensive positions on Bataan. Maj. Gen. Albert M. Jones took command of the South Luzon Force. These troops passed around Manila on the night of December 30, and by dawn of the next day had crossed the dangerous bottleneck of the Calumpit bridges, which had been kept open by Wainwright's troops. (Manila itself had been declared an open city on December 26, but it was bombed repeatedly by the Japanese during the succeeding days.) On Jan. 1, 1942, Wainwright withdrew his forces to the Borac-Guagua line covering Bataan. There two Philippine divisions held off Japanese attacks until January 4 in order to allow the rest of MacArthur's forces to get into position on Bataan and prepare for the defense of the peninsula. By January 7, USAFFE was in position and organized for defense, with the forward line extending from Moron through Mount Natib to Abucay.

*Fall of Bataan and Corregidor.*—Behind the forward defense line the USAFFE forces were organized into two corps. The 1st Corps, under General Wainwright, held the western sector, while the 2d Corps, under General Parker, defended the eastern sector. A reserve battle position extended from Bagac to Orion, and behind a line running roughly through Mariveles was the Service Command Area. The USAFFE reserve, consisting of elements of the reliable Philippine Division, was behind the reserve battle position in General Parker's sector, the sector containing the best routes for the Japanese advance. The forces on Bataan totaled about 80,000 men, including 15,000 Americans. Approximately 2,000 troops, who had been cut off in the retreat to Bataan, fled to the hills of Luzon and conducted guerrilla warfare. Food, housing, and sanitation problems on Bataan were greatly complicated by the presence of more than 26,000 civilian refugees, a contingency that had not been foreseen in planning the defense of the peninsula. All troops were

**Map 37. FALL OF BATAAN AND CORREGIDOR (Jan. 1-May 6, 1942).** Maj. Gen. Jonathan M. Wainwright held the escape route over the Calumpit bridges open for the South Luzon Force; then all retired to the defenses of Bataan. With no possible hope of outside assistance, the Filipino-American forces fought stubbornly for four months, encumbered by thousands of civilian refugees. Starvation, disease, and lack of supplies and munitions gradually reduced them to impotence. Overwhelmed, they surrendered on May 6.



immediately placed on half rations. With the United States Pacific Fleet virtually immobilized after the attack on Pearl Harbor and the Japanese in control of the waters surrounding the Philippines, the Bataan garrison would have to fight it out with its own limited resources.

Japanese probing attacks against the forward line began on January 9. Determined to conclude the Bataan campaign expeditiously, General Homma began to apply relentless pressure on January 10. The crisis came on January 22, when penetrations on both flanks of the forward line made the position untenable despite vigorous Allied counterattacks. A withdrawal to the reserve battle position was ordered and was completed by daylight on January 26. Meanwhile, on January 23, the Japanese began a series of landings on the southeastern tip of Bataan. Initially, they were opposed only by miscellaneous troops in the vicinity of the landings. Constabulary, Air Corps personnel, sailors, and Marines, organized into provisional units, held the invaders at the beaches until two regiments could be brought up from the front. These struggles, known as the Battle of the Points, continued until February 13, when the last of the Japanese were driven into the sea.

Concurrently with the amphibious landings in the south, General Homma launched an attack on January 26 against the 1st Corps sector, during which a Japanese regiment passed almost unnoticed through the Allied lines and reached an area deep in the rear. General Wainwright executed a series of counterattacks in what became known as the Battle of the Pockets. The Japanese resisted stubbornly, and it was not until mid-February that the pockets had been reduced and the battle position restored. In the meantime, Japanese attacks were made in the 2d Corps sector on January 27 and 28, but these were repulsed. The collapse of his offensive was a severe shock to General Homma. Operations in every other theater were meeting with phenomenal success, particularly in Malaya, where Singapore had fallen

with a bag of 73,000 prisoners. Since Homma had been required to relinquish one of his divisions for scheduled operations in Java, his effective fighting strength had been so much reduced that it was necessary to suspend offensive operations for the time being. Moreover, he had already suffered 7,000 casualties, and between 10,000 and 12,000 of his men were hospitalized with tropical diseases.

Homma counted on a scarcity of food to weaken the defenders of Bataan while he awaited reinforcements, and his hopes were realized. Stocks for the 78,000 troops and 26,000 civilians on Bataan dwindled steadily. An occasional submarine arrived with food, but more often the cargo consisted of much-needed drugs or ammunition. Malnutrition led inevitably to physical wastage and greater susceptibility to disease. Vitamin deficiency caused the almost universal spread of beriberi, while every day hundreds of soldiers suffering from malaria, dysentery, or hookworm were admitted to field hospitals. By March 11, the troops were on one-third rations, and offensive action by the half-starved forces was no longer practicable.

On February 22, President Franklin D. Roosevelt ordered General MacArthur to proceed to Australia to become supreme commander of the Allied forces in the Southwest Pacific. He left on March 11, and General Wainwright took command of the newly constituted Luzon Force, comprising all troops on Bataan. General Jones succeeded to the command of Wainwright's 1st Corps. On March 19, Wainwright was promoted to the rank of lieutenant general and became commander of the United States forces in the Philippines; Maj. Gen. Edward P. King, Jr., took over command of the Luzon Force.

Homma began to receive a steady stream of reinforcements, and by mid-March the increased activity of Japanese aircraft and artillery pre-  
saged a new offensive. Probing attacks began on the left of the 2d Corps sector on March 27, and

pressure there grew steadily until April 3. Then, with heavy air, artillery, and tank support, the Japanese infantry attacked in strength. The Allied troops, now on quarter rations, counterattacked as best they could but were unable to prevent the collapse of the 2d Corps' left flank. Virtually all of the 1st Corps was moved to the 2d Corps sector in an attempt to stem the Japanese advance, but had little success. Gradually the troops were driven down the east coast of Bataan until, on April 9, General King, realizing the hopelessness of the situation, surrendered the Luzon Force to General Homma. The latter, who had expected the surrender of all troops in the Philippines, was furious when he learned that King spoke only for the Luzon Force. The Bataan garrison then began its long death march to Camp O'Donnell in central Luzon. It is known that on May 10 about 45,000 Filipino soldiers and 9,300 Americans were imprisoned in the camp; the remainder of the Bataan troops perished in the last fighting or during the death march and subsequent incarceration at Camp O'Donnell. A handful escaped to the hills to carry on as guerrillas.

Japanese attention was now focused on Corregidor, the last Allied stronghold in the Philippines. The island, which lies off the southern tip of Bataan, was the key bastion in the chain of island forts that stretched across the 11-mile entrance to Manila Bay. With the fall of Bataan, the Japanese lost no time in moving their artillery to Mariveles on the south coast. Then began an intensive bombardment, in which heavy guns on the south shore of Manila joined. By April 14, most of the fixed guns on Corregidor had been put out of action. Enemy aircraft supplemented the shelling with incessant bombing attacks that contributed impressively to the destruction of the matériel and morale of the defenders. Artillery fire continued throughout most of each day. It was estimated that on May 4 alone more than 16,000 shells hit Corregidor.

On May 5 and 6, Japanese landing barges approached the northern shores of the island. The Allied light field guns, which had been kept protected from bombardment, went into action and

sank many of the barges, but the Japanese gained a foothold ashore. Wishing to end hostilities before nightfall (since his enemy by then might be among the many sick and wounded in Malinta Tunnel), General Wainwright offered the surrender of Corregidor to General Homma on the afternoon of May 6. The Japanese commander insisted on the surrender of all troops in the Philippines. The situation was such that the American commander had no choice; he complied at midnight, May 6. The 11,500 surviving Allied troops, exhausted by incessant bombardment and undernourishment, were evacuated to a prison stockade in Manila.

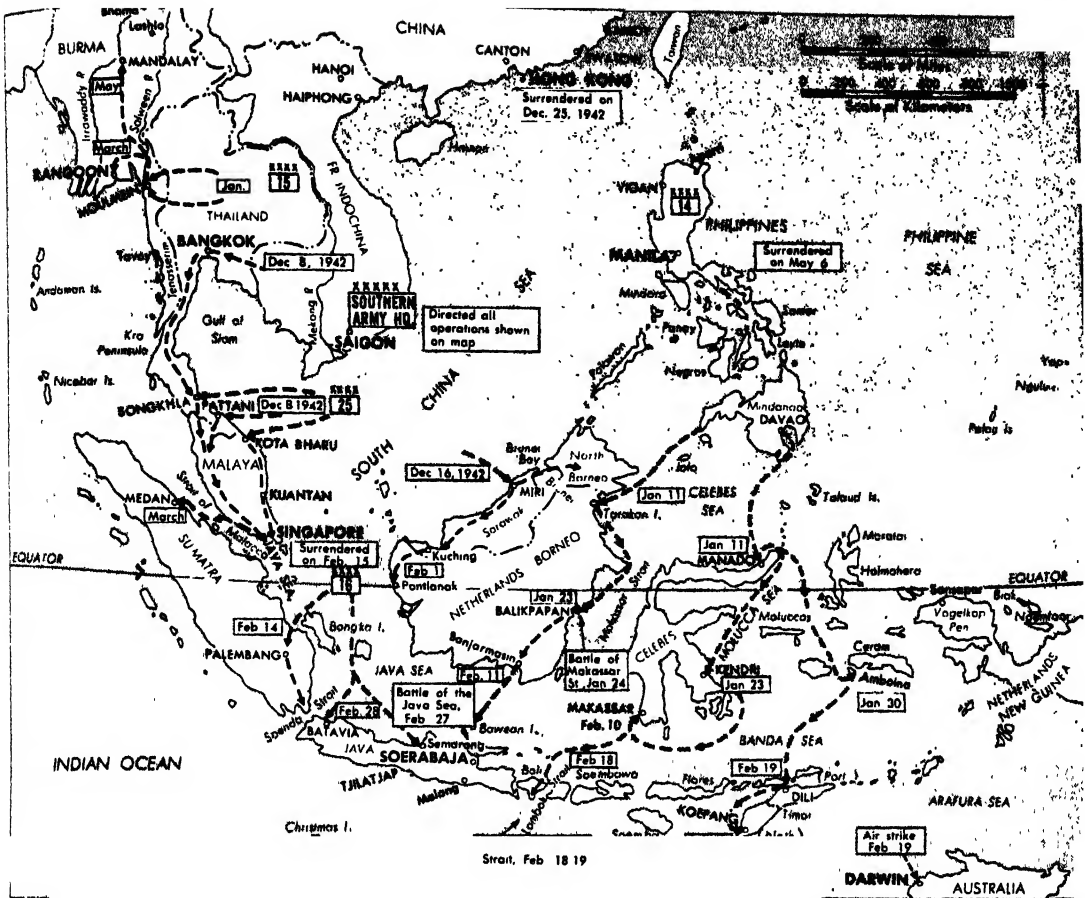
**Capture of the Southern Philippines.**—The operations that took place on the southern islands concurrently with those on Luzon were comparatively small. The principal objective of the Japanese in this area was to seize bases for the support of the coming invasion of the Netherlands East Indies. They were content to capture initially the most important points on the major islands, leaving the interior areas to be mopped up later. The defense of the southern Philippines was entrusted to the Visayan-Mindanao Force, commanded by Col. (later Maj. Gen.) William F. Sharp. This force consisted of the equivalent of four Philippine Reserve divisions and a regiment of Constabulary troops; it had practically no artillery. Most of the troops were posted on Mindanao, part of one division held Cebu, and part of another defended Panay. On December 8, aircraft from 2 small Japanese carriers struck Davao, principal city of Mindanao, inflicting considerable damage on the few military installations there and destroying 2 long-range naval patrol bombers. The Japanese landed in strength near Davao on December 20, two days before the main landing on Luzon; drove off the weak Allied resistance, and, with the aid of the many Japanese civilians living in and about the city, established a firm perimeter defense around Davao and the adjacent airfield. On Christmas Day, the Japanese occupied the island of Jolo and began the construction of a large air base. On December 31, another beachhead was established on Mindanao, at Digos. While these operations were in progress, American long-range Army bombers, based at Darwin, Australia, and Navy patrol bombers, based at Amboina (now Ambon), Netherlands East Indies, made limited attacks on Japanese shipping supporting the landings, but without substantial results.

When General Homma realized that the capture of Bataan was not enough to force the surrender of all the Philippines, he sent additional troops to crush resistance in the other islands. Cebu was assaulted on April 10, and Panay on April 16, and additional landings were made on Mindanao: near Cotabato on April 29, and at Cagayan on May 3. The Visayan-Mindanao Force, only partially trained and fighting without artillery, could offer little effective resistance to the determined Japanese attacks. Gradually, the troops moved back into the hills to conduct guerrilla operations. On May 6, General Wainwright had agreed to surrender all troops in the Philippines. Fearing reprisals against the Luzon and Corregidor troops already surrendered, he sent couriers to the island commanders in the south, instructing them to capitulate. General Sharp accordingly surrendered the forces on Mindanao on May 10; three days later, Brig. Gen. Bradford G. Chynoweth surrendered the troops on Cebu and

Corregidor surrendered to the Japanese at midnight, May 6, 1942. Here its heroic American defenders, exhausted by their long ordeal, are being marched to captivity.

Wide World





Map 38. CONQUEST OF THE NETHERLANDS EAST INDIES (Jan. 11–March 9, 1942). Except in the Philippines, the offensives of the Japanese progressed so well that they were able to begin operations in the Netherlands East Indies sooner than scheduled. The Allies concentrated such air and naval forces as they could for the defense of the Indies, but they were gradually overpowered by greatly superior forces. On March 9, the Dutch surrendered the islands to the Japanese. The map shows the successive Japanese landings in the Indies; it also shows schematically the opening operations on the Southeast Asian mainland.

Panay. Many civilians and troops who did not choose to surrender fled into the hills and organized guerrilla bands.

**Conquest of the Netherlands East Indies.**—The East Indies comprised the richest portion of the Southern Regions. The Japanese conquest of this prize would have to await the end of the campaigns in Malaya and the Philippines, when adequate forces and bases would become available. The problems of defending the Indies were much the same as those encountered in the Philippines. The string of islands extends east and west for about 3,000 miles. Java, the most populous island, was highly developed, but the other islands were generally undeveloped and had limited land communications. A gigantic army would be needed to defend all of them. In December 1941, the Dutch Army in the Indies numbered about 140,000 men, who were concentrated mainly on Java. These were mostly native troops, poorly equipped and of uncertain combat efficiency. Available Dutch naval forces included 3 cruisers, 7 destroyers, and 16 submarines. The principal naval base was at Soerabaja (now Surabaya), Java. About 150 aircraft of all types, generally obsolete, provided the air defense of the entire

Netherlands East Indies. Airfields were situated at key points on all major islands, with the largest bases on Java.

When the United States Asiatic Fleet withdrew from the Philippines, it began to operate from Soerabaja. Meanwhile, American Flying Fortress bombers that had withdrawn from the Philippines to Australia prepared to move into the Dutch air bases. By the end of 1941 the Allied situation in the Far East was deteriorating rapidly. Hong Kong had fallen, Allied troops in the Philippines were being compressed onto the Bataan Peninsula, Singapore was in grave danger, and the Japanese had established strong bases in northern Borneo and the southern Philippines. Under this pressure, Allied cooperation began to show signs of strain: the Australians urged adequate defense of their country, the British stressed the importance of holding Singapore, the Americans sought reinforcements for their beleaguered troops in the Philippines, and the Dutch pressed for assistance in the defense of the Indies. In an attempt to unify the direction of the Allied war effort in the Far East, Gen. (later Field Marshal) Sir Archibald Wavell (later 1st Earl Wavell) was designated supreme commander for all American,



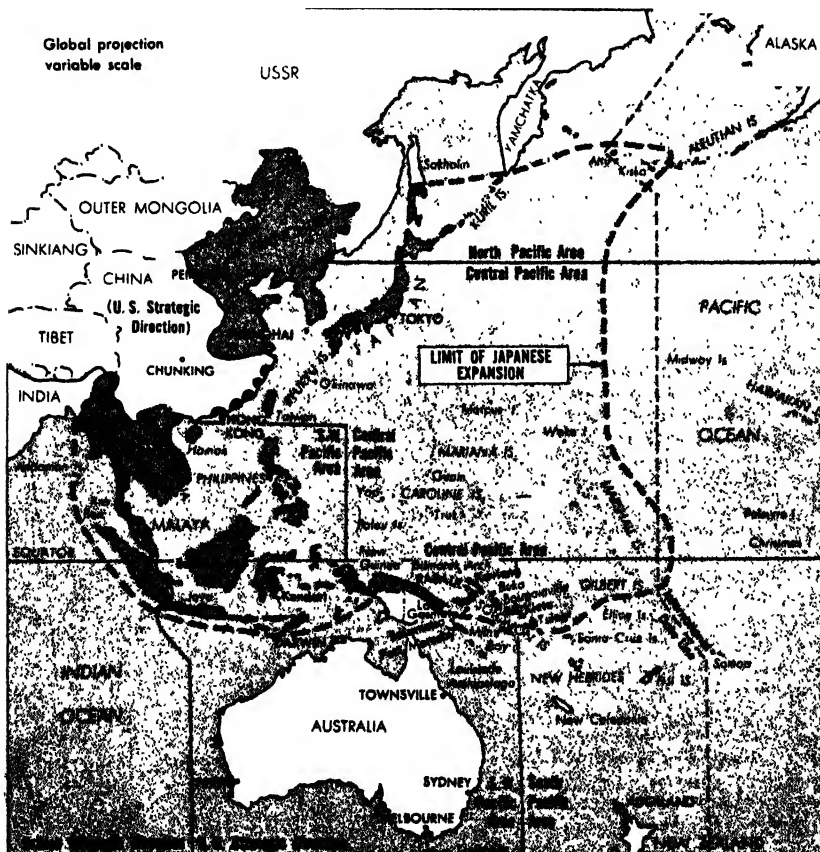
British, Dutch, and Australian forces. Wavell named his forces the American-British-Dutch-Australian Command (ABDACOM). Allied defensive strategy was now directed toward holding the Malay barrier, which was defined as the Malay Peninsula-Sumatra-Java-northern Australia line, with Burma and Australia as the essential supporting positions on its flanks. Communications with Luzon were to be reestablished and kept open through the northern Indies. The British sent reinforcements to Malaya and Burma and arranged for the return of two Australian divisions from the Middle East, and the United States made every effort to dispatch troops, supplies, and aircraft to the Indies.

All of these efforts were in vain. The rapidity of Japanese successes in the initial offensives made it possible to begin operations against the Indies sooner than had been expected. On Jan. 11, 1942, the first attacks were launched—at Tarakan, the Borneo oil port, and at Manado (Menado), a key base in Celebes. Succeeding landings are best shown on Map 38. At all places the Japanese easily overcame Dutch resistance. The small Allied air force could do little against greatly superior Japanese airpower. Allied naval strength in the area consisted of only 9 cruisers, 23 destroyers, and 36 submarines. Nevertheless, though no match for the vastly superior Japanese Fleet, the Allied warships attacked repeatedly. In the early dark hours of January 24, 4 Allied destroyers attacked a large convoy off Balikpapan, Borneo. In this, the Battle of Makassar Strait, the destroyers escaped unharmed after sinking 4 Japanese transports and a patrol ship and damaging

other vessels. Subsequent engagements—the Battle of Lombok Strait (February 18-19) and the Battle of the Java Sea (February 27)—were not as successful for the Allies. In the latter losses from Japanese air and naval attacks were so severe that the surviving Allied warships were withdrawn from the Java Sea to Tjilatjap (Chilachap) on the south coast of Java. On February 28, 2 Allied cruisers, the *Houston* and the *Perth*, which were attempting to escape southward through Soenda (now Sunda) Strait, suddenly ran into a huge Japanese invasion armada in the process of assaulting Batavia (now Djakarta). The cruisers were destroyed, but only after sinking 3 loaded Japanese transports.

The few Allied aircraft and warships that remained were ordered to withdraw to Australia. On March 9, the Dutch finally surrendered the Netherlands East Indies to the Japanese. Allied attention was now directed to the defense of Australia. The enemy was not far away.

**Establishment of the Defensive Perimeter.**—The Bismarck Archipelago, northeastern New Guinea, and Bougainville and Buka in the Solomon Islands were all mandated to Australia after World War I. The rest of the Solomon Islands constituted a British protectorate, and Papua (southeastern New Guinea) was an Australian territory. Dominating the northern shores of the Coral Sea, these islands provided excellent bases for attacks on Australia and the supply lines from the United States, which now ran a circuitous route through New Caledonia, Fiji, and Samoa to Hawaii. The principal Japanese objective in the area was Rabaul in the Bismarcks. It



Map 39. LIMIT OF JAPANESE EXPANSION (Aug. 6, 1942). The map shows the maximum extent of the Japanese conquests (heavy broken line and shaded areas). It also shows the United States and British spheres of strategic direction and the division of the American sphere into North, Central, South, and Southwest Pacific areas.

had a splendid natural harbor, the contiguous terrain was ideal for airfields, and from it control could be exercised over the area bounded by New Guinea, the Bismarck Archipelago, and the Solomon Islands.

While Japanese forces in the Netherlands East Indies were pouring ashore at Balikpapan and Kendari, Celebes, on January 23, their Fourth Fleet was engaged in assaulting Rabaul, Kavieng, and Kieta. The only opposition encountered was at Rabaul, where 1,400 Australian troops opposed more than 4,000 Japanese. About 400 of the defenders eventually escaped to Australia. Gasmata, New Britain, was occupied on February 8, and on the night of March 7-8, landings were made at Lae and Salamaua on the north coast of New Guinea. The Allies countered with an air attack on Rabaul by 6 bombers of the United States Fifth Air Force, based at Townsville, Australia, and a daring air strike by an American carrier-aircraft task force over the high mountains of New Guinea against Japanese shipping at Lae and Salamaua. Some damage was inflicted, but the Japanese occupation was not hindered. The Pacific defensive perimeter, as envisioned by the basic war plan of Japanese Imperial General Headquarters, had now been established.

**Expansion of the Defensive Perimeter.**—It was now time for the second phase of the Japanese war plan, consolidation and strengthening of the defensive perimeter, but the unexpected ease with which the initial offensives had been carried out lured the Japanese High Command into a program of further expansion. It was decided to occupy the Solomon Islands and Port Moresby, Papua, in order to strengthen the original perimeter through New Guinea and the Bismarcks. These conquests would pave the way for the subsequent occupation of New Caledonia, Fiji, and Samoa, thus severing the supply lines between the United States and Australia. Expansion of the perimeter to include the Midway Islands in the Central Pacific and Attu and Kiska in the Aleutian Islands was also contemplated.

The first operation was the capture, on May 3, of Tulagi in the southern Solomons. By July, all of the major islands of the Solomon group had been occupied by the Japanese. A strike by an American naval carrier task force against the invading convoy at Tulagi sank or damaged several destroyers and a number of smaller vessels with a loss of only 3 planes. Forewarned that a strong amphibious force was to move through the Coral Sea to occupy Port Moresby, Allied naval forces assembled for the approaching battle. (The Americans had broken the Japanese secret code before the outbreak of the Pacific war and often gained valuable information on impending operations.) The invasion armada was discovered by scouting planes off the Louisiade Archipelago on May 7, and Rear Adm. (later Vice Adm.) Frank J. Fletcher moved his American task force northward. About noon, his carrier aircraft attacked and sank a Japanese escort carrier. Early on the next day, the opposing carrier groups located each other and launched their aircraft for what was to be the first carrier-against-carrier battle in history and the first major naval battle to be fought without an exchange of shots by surface ships. In the resulting engagement, American planes damaged 1 Japanese carrier, while the Japanese inflicted damage to both American carriers, the *Yorktown* and the *Lexing-*

*ton*. The latter was so badly damaged that she had to be sunk. In this two-day Battle of the Coral Sea, the Japanese lost 105 carrier aircraft; the Americans, 81. Tactically, the engagement was a draw; strategically, it was an important American victory, because the Japanese turned about and abandoned their amphibious operation against Port Moresby.

Again by virtue of knowledge of the Japanese code, it was learned that a gigantic operation was planned to occupy Midway and destroy American naval strength in that area. Admiral Fletcher left the Coral Sea and hastened to join the naval forces of the Central Pacific for the coming battle. Meanwhile, General MacArthur set about strengthening Port Moresby and other bases in eastern New Guinea and established an air base at Milne Bay.

#### RECOVERY AND VICTORY OF THE ALLIES

The stunning defeat inflicted on the Japanese Navy at Midway in June 1942 caused the American Joint Chiefs of Staff to order the adoption of a more aggressive policy for the South and Southwest Pacific. The overextension of the Japanese in their widespread operations made this policy feasible. The Japanese were faced with the difficulty of supplying troops thousands of miles from home and along a front that extended from India through Malaya, the Netherlands East Indies, New Guinea, and the Solomons, and thence northward through the Gilbert Islands to the Aleutians. Allied submarines and planes had taken an increasingly larger toll of shipping as the months went by, and the speed that had characterized early Japanese operations could no longer be maintained because there were fewer ships to cover greater distances.

The operations prescribed by the Joint Chiefs of Staff envisaged a two-pronged offensive, with one prong directed toward northern New Guinea from Port Moresby and the other up the chain of the Solomons. The final objective of both drives was the recapture of Rabaul, the principal Japanese base in the Southwest Pacific. These two offensives, the Guadalcanal campaign in the Solomons and the Papuan campaign in New Guinea, were the first Allied steps on the road that was to lead to Tokyo.

**Guadalcanal Campaign.**—Japanese troops and construction personnel had landed on the north shore of Guadalcanal on July 6, 1942, and had begun to develop an airfield and a base for subsequent operations. The American objective was to seize these installations and drive the invaders from the island. Vice Adm. Robert L. Ghormley, commander of the South Pacific Area, with headquarters at Auckland, New Zealand, planned and exercised over-all direction of the Guadalcanal offensive. Admiral Fletcher commanded the two task forces to be employed: the Amphibious Force and the Air Support Force. The Amphibious Force, under Rear Adm. (later Adm.) Richmond K. Turner, was composed of transport and naval support groups aggregating 23 transports, 8 cruisers, 15 destroyers, and 5 minesweepers. Aboard the transports were the 1st Marine Division, the 2d Marine Regiment of the 2d Marine Division, and other troops totaling 19,500 men, commanded by Maj. Gen. (later Gen.) Alexander A. Vandegrift. The Air Support Force consisted of 3 large carriers (the *Saratoga*, *Enterprise*, and *Wasp*), the battleship *North Carolina*, 6 cruisers, and 16 destroyers. This force, under Rear Adm.

Leigh Noyes, was to provide air support for the assault and security against hostile air attack. All land-based planes in the South Pacific (a total of 291, including Army planes) were to be controlled by Rear Adm. (later Vice Adm.) John S. McCain, air commander under Admiral Ghormley.

General MacArthur agreed to use Southwest Pacific air forces to interfere with any Japanese attempt to send reinforcements from Rabaul and to keep that base under strong air attack during the American landings on Guadalcanal. Adm. (later Admiral of the Fleet) Chester W. Nimitz, commander in chief of the Pacific Fleet, agreed to post submarines to interfere with any dispatch of reinforcements from the Japanese base on Truk.

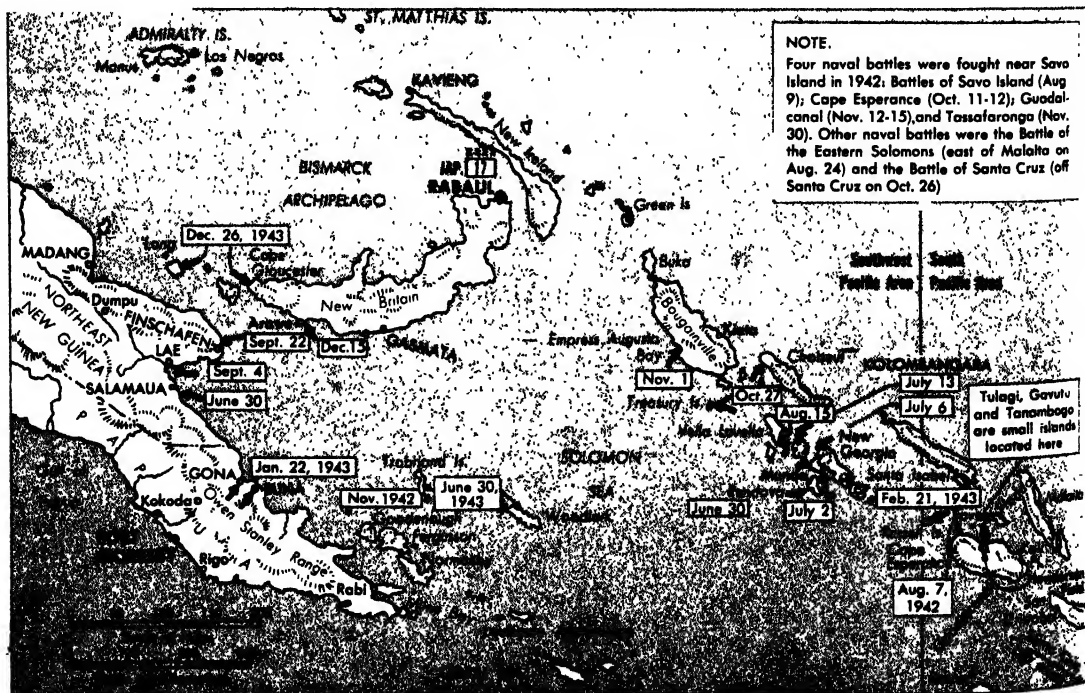
On August 6, as the American invasion fleet approached Guadalcanal from the south, there were actually only 1,500 Japanese in the Tulagi area and about 2,230 on Guadalcanal itself, concentrated near the airfield. Of these, 600 and 1,700, respectively, were labor troops of inferior fighting quality. Heavy air and naval bombardment preceded the landings, which were made on schedule the next morning. Tulagi, Gavutu, and Tanambogo islands, in the Florida group opposite the north coast of Guadalcanal, were captured by the morning of August 8 despite do-or-die fighting by the Japanese. The landings on Guadalcanal were unopposed, and the Marines moved inland without making contact with the Japanese on the first day. On August 8, the advance continued, the airfield (later named Hen-

derson Field in honor of a Marine Corps pilot hero of the Battle of Midway) was captured, and a defensive perimeter established around it, all against light opposition.

The American occupation of Guadalcanal provoked a violent reaction by the Japanese. They seem to have attached great importance to its recovery, for a captured Japanese document reads in part: "Success or failure in recapturing Guadalcanal . . . is the fork in the road which leads to victory for them or for us." Guadalcanal was to be a magnet that attracted powerful Japanese forces and a sinkhole in which they were dissipated. Costly naval battles were to be fought for three months, and the bitter struggle on the ground was to continue for half a year.

Despite the efforts of MacArthur's planes to keep Rabaul neutralized, large bomber groups were launched from the base to attack the American ships off Guadalcanal. Although many planes were destroyed, the attacks were renewed repeatedly. On the morning of August 8, the carriers of the Air Support Force retired to the south, and it was decided to withdraw all the other ships, including those of the Amphibious Force. Their departure was accelerated by a surprise night raid early on August 9 against American warships off Savo Island. In this Battle of Savo Island, 4 American cruisers were sunk, and 1 cruiser and 2 destroyers were damaged. The Japanese ships escaped without harm. Thus the Marines were left ashore without naval or air support and with meager supplies. Under the

**Map 40. ALLIED VICTORIES IN NEW GUINEA AND THE SOLOMON ISLANDS (August 1942–December 1943).** In August 1942, American troops took the offensive and invaded Guadalcanal. The Japanese poured reinforcements into the island, and one of the most bitter battles of the war ensued. Eventually the Japanese were defeated with heavy losses. South Pacific forces then began a long hard drive up the Solomon chain, as shown. By the end of 1943 they were in possession of the Solomons. Meanwhile, Southwest Pacific forces had taken up the offensive in Papua and northeastern New Guinea. They drove the Japanese from their principal bases at Buna and Gona and continued the offensive along the northeast coast of New Guinea. Rabaul, New Britain, the key Japanese base, was virtually encircled and isolated by these drives. The Allies had wrested the initiative from the Japanese and were to hold it for the remainder of the war.



United States Marines search a palm grove on Guadalcanal for Japanese snipers and stragglers soon after they landed on the island on Aug. 7, 1942.

Wide World



circumstances, General Vandegrift could do no more than concentrate his forces for the defense of the perimeter surrounding Henderson Field and request reinforcements.

On August 18, the first Japanese reinforcements, totaling approximately 1,000 men, arrived on the island. They attacked the Marines on August 21 and were almost annihilated. Meanwhile, on August 20, 19 Marine Corps fighters and 12 dive bombers arrived at Henderson Field; two days later, the first 5 Army planes landed.

A huge Japanese invasion fleet had left Rabaul on August 19 under continuous cover by land-based aircraft. It comprised 3 carriers, 8 battleships, 6 cruisers, 21 destroyers, and 4 troop transports. American forces gathered to intercept it, but all that could be mustered were 2 carriers, 1 battleship, 4 cruisers, and 10 destroyers. Also available were 36 planes on Guadalcanal and 69 long-range patrol bombers. In the ensuing Battle of the Eastern Solomons, fought on August 24, airpower decided the issue. The Japanese, all but stripped of their carrier aircraft, broke off the fight and withdrew. They had lost 1 carrier, 1 cruiser, and 1 destroyer; 1 seaplane carrier and 1 light cruiser were damaged; and about 90 of their aircraft were shot down. American losses consisted of 1 carrier (the *Enterprise*) damaged and 20 planes destroyed.

The Japanese now began to reinforce Guadalcanal by means of fast destroyers, the decks of which were loaded with men and equipment. These approached the island under cover of darkness, unloaded, and sped away before dawn. Troops and equipment were also moved in large landing craft from island to island down the chain of the Solomons, sailing by night and hiding by day. Between August 29 and September 11, approximately 6,000 troops were landed by these means. On September 13 and 14, the Japanese made determined attacks against the Marine position on Bloody Ridge but were repulsed with heavy losses. It now became evident to the Japanese that large forces, tanks, and artillery were needed to dislodge the Marines. The Seventeenth Army, with headquarters at Rabaul, was formed under Lt. Gen. Haruyoshi Hyakutake. The "Tokyo Express," as the swift-moving convoys of troop-ferrying destroyers and cruisers came to be known, operated almost nightly during the latter part of September and early October, building up Japanese strength on Guadalcanal. Meanwhile, the Marines were being reinforced. On September 18, the 7th Regiment

of the 1st Marine Division arrived. Additional squadrons of fighters and dive bombers came to Henderson Field. Coast defense guns were emplaced, and more supplies and equipment reached the troops. On October 13, the 164th Infantry Regiment of the Army Americal Division also arrived.

During the period October 23-26, mostly days of torrential downpours, General Hyakutake made his final bid for victory. Heavy artillery shelled Henderson Field almost incessantly. At times the heavy rains turned the airfield into a sea of mud, preventing American aircraft from leaving the ground and giving the Japanese free rein in the air. But the frequent and violent tank-infantry attacks were beaten back with heavy losses. After a last futile effort on the night of October 25-26, Hyakutake abandoned the land offensive and, on about October 29, began a general withdrawal. General Vandegrift now moved westward to drive his enemy out of artillery range of Henderson Field.

In the meantime, persistent efforts by the Japanese Navy to reinforce the island resulted in a number of naval engagements. During the night of October 11-12, a Japanese force of 4 cruisers and 1 destroyer was intercepted and surprised by Rear Adm. Norman Scott's task force of 4 cruisers and 5 destroyers. In the resulting Battle of Cape Esperance the Japanese lost 1 cruiser and 1 destroyer sunk and 2 cruisers damaged. American losses consisted of 1 destroyer sunk and 2 cruisers and 1 destroyer damaged. As the battle ashore reached its peak on October 26, the two navies clashed in the Battle of Santa Cruz north of the Santa Cruz Islands. The Japanese armada consisted of 4 carriers, 4 battleships, 9 cruisers, 28 destroyers, and 7 other vessels. The much weaker American task force comprised 2 carriers, 1 battleship, 6 cruisers, and 14 destroyers. In this one-day naval-air battle, 3 Japanese carriers and 2 destroyers were damaged, but none were destroyed, although about two thirds of the 170 to 180 Japanese carrier aircraft were shot down. The American force suffered heavily and was forced to withdraw. The aircraft carrier *Hornet* and a destroyer were sunk, and the carrier *Enterprise*, the new battleship *South Dakota*, a cruiser, and a destroyer were damaged; 74 American planes were also lost.

The last major naval battle off Guadalcanal consisted of a series of engagements during the period November 12-15, known as the Battle of

Guadalcanal. In three days of fighting the Japanese lost 2 battleships, 1 cruiser, 3 destroyers, and 11 transports sunk; 3 cruisers and 6 destroyers were damaged. In addition, thousands of ground troops drowned when the transports were sunk. American losses totaled 2 light cruisers and 7 destroyers sunk and 8 other vessels damaged. A damaged light cruiser was sunk by Japanese torpedoes while retiring. The final but lesser naval action was the Battle of Tassafaronga, fought in the narrow channel south of Savo Island on the night of November 30. An American force of 5 cruisers and 6 destroyers intercepted 8 Japanese destroyers carrying troop and equipment reinforcements. The smaller warships had the advantage in the constricted waters, and American radar was ineffective against targets close to shore. The Americans came off second best, losing 1 cruiser and suffering severe damage to 3 others. The Japanese lost only 1 destroyer, but the remainder turned about and failed to land their troops and cargo ashore.

The ground fighting continued sporadically after the abortive Japanese offensive of October 23-26. On the night of November 2-3, about 1,500 Japanese landed near Koli Point. By November 8, they had been encircled, and less than half of them escaped. American ground strength now grew rapidly. On November 4, the 8th Regiment of the 2d Marine Division disembarked; on November 12, 6,000 reinforcements, including the 182d Infantry Regiment of the Americal Division, arrived. Ground activity for the rest of the year was confined largely to constant pressure on the Japanese, and Marine Corps and Army troops advanced as far as Point Cruz.

The Japanese situation deteriorated rapidly after the costly defeat suffered in the naval Battle of Guadalcanal. Only small quantities of supplies and not more than 1,000 troop replacements were able to reach the island during the rest of the campaign. The food situation became desperate, and disease took an increasing toll. In January 1943, General Hyakutake departed with his headquarters for Bougainville, and other senior commanders began to desert their troops and head northward.

By this time, Maj. Gen. (later Lt. Gen.) Alexander M. Patch, now in command of the island garrison, had approximately 50,000 men. His principal tactical unit was the new 14th Corps, composed of two Army divisions, the Americal and the 25th, and the 2d Marine Division. Beginning on December 9, the 1st Marine Division had left for a well-merited rest. A general offensive was launched, and though the remaining Japanese fought bitterly, they were gradually forced westward into the point at Cape Esperance. The Tokyo Express now began operations in reverse, evacuating rather than strengthening the garrison. The Americans reached Cape Esperance on February 9, bringing the campaign to a close.

For the Japanese, Guadalcanal was a costly experience. In addition to many warships and hundreds of planes with their experienced pilots, they had lost 14,800 ground troops killed or listed as missing, 9,000 through sickness, and about 1,000 captured. Only 13,000 men were evacuated. American troop casualties totaled 1,600 killed and 4,245 wounded, of whom 1,042 killed and 2,894 wounded were Marines.

**Papuan Campaign.**—The offensive in New Guinea, which General MacArthur had been or-

dered to launch simultaneously with the Guadalcanal offensive, was to start from Port Moresby and was designed to drive the Japanese from the northeast coast of the island. A Japanese amphibious force sent to capture Port Moresby had been turned back in May 1942 in the Battle of the Coral Sea. Now the Japanese planned to seize the town by an overland advance.

On July 22, Maj. Gen. Tomitaro Horii landed 4,400 troops at Gona, on the northeast coast of Papua, and quickly occupied Buna. By July 28, elements had penetrated inland to Kokoda, high in the Owen Stanley Range, where they encountered Australian resistance. Additional men and supplies arrived on the coast, and a base was established in the Buna-Gona area. By August 22, more than 11,000 Japanese were ashore, and the drive on Port Moresby began in earnest. The Australians delayed the advance courageously, and by mid-September had halted it at a point less than 32 miles from Port Moresby. Meanwhile, in the last days of August, 2,000 Japanese had landed at Milne Bay, on the southeastern tip of Papua, in order to seize the airstrip there and advance along the coast to Port Moresby. The attempt was a complete failure. Australian troops killed more than 600 of the invaders; most of the rest were evacuated by destroyer, while a few made their way up the coast to Buna. The Japanese supply line over the difficult mountains, tenuous at best, was almost broken by relentless bombing and strafing attacks by Allied planes.

By the end of September, MacArthur had in Papua the Australian 7th Division, commanded by Maj. Gen. George A. Vasey, and the 126th and 128th Infantry regiments of the American 32d Division, commanded by Maj. Gen. Edwin F. Harding. He now ordered a counterattack against the half-starved Japanese. At this time the Japanese situation on Guadalcanal was critical, and just as MacArthur's offensive was launched, the forces operating against Port Moresby were recalled to Buna. Allied troops then converged on Buna, the Australians moving over the Kokoda Trail and the Americans overland, by air transport to improvised airfields at Wanigela and Pongani, and by small boats along the north shore. By November 18, the outposts of the Buna position had been reached. It was an exceedingly strong position, for the Japanese had taken every advantage of the swampy terrain and dense tropical vegetation. Three strong defenses, each almost completely hidden, had been constructed: one was in front of Buna and the airstrip to the southeast, another lay across the Soputa-Sanananda road, and the third was the village of Gona. The position at Buna, held by about 2,200 Japanese, was in the zone of the American 32d Division; the other two, with a total garrison of more than 3,000, were in the zone of the Australian 7th Division.

The battle was to be essentially a slugging match between ground forces. The United States Navy would not risk its ships in the uncharted waters off Buna. Allied planes could not identify targets in the dense undergrowth and dropped bombs on their own troops, causing some casualties and seriously affecting morale, which was already depressed by the swampy terrain, high humidity, and numerous jungle insects and blood-sucking leeches. An attack in the rain against Buna on November 19 failed; an all-out attack along the entire Buna front on



November 22 was equally fruitless. On the same day, the Australians, reinforced by two American battalions, launched a general attack against Gona and along the Soputa-Sanananda road. No headway was made, but American troops had begun to work their way around the Japanese position on the road, and by November 30 they had established a roadblock behind the Japanese, thereby cutting the supply line to Sanananda. The next three weeks were spent in maintaining this roadblock against desperate enemy attacks from all sides.

On December 1, Lt. Gen. Robert L. Eichelberger was summoned to revitalize the American front before Buna. He arrived in time to see the failure on December 2 of a major assault by the 32d Division, which depressed troop morale to probably its lowest point. After reorganization another general offensive was launched against the Buna position on December 5. It was generally unsuccessful, but one unit broke through the Japanese lines west of Buna and established a narrow corridor to the coast. Reinforcements arrived on December 15, and the village of Buna was captured. By December 17, an Australian brigade with tanks had arrived in the American sector, and an attack was made the next morning. Progress was slow but steady. By Jan. 2, 1943, the Buna position had been taken. All efforts were now directed toward Sanananda and Gona. By January 22, organized Japanese resistance had ceased, and the Papuan campaign came to an end. About 12,000 Japanese, 2,000 Australians, and 850 Americans died in this campaign.

**Operations in 1943.**—By the beginning of 1943, with their victories on Guadalcanal and in Papua, the Allies had definitely wrested the initiative from the Japanese in the South and Southwest Pacific areas. Since the preponderance of Allied resources in the Pacific theater were devoted to these operations, little could be done in the Central and North Pacific after the Battle of Midway. Admiral Nimitz' operations for the rest of 1942 had therefore been limited to submarine warfare and raids on Japanese island bases by air and light naval forces. In Burma, while awaiting reinforcements, the British were organizing their forces for limited land and amphibious operations to capture Akyab, and Lt. Gen. (later Gen.) Joseph W. Stilwell was working feverishly to organize Chinese divisions and train them into effective fighting units. An air transport system had been put into operation over the 500 miles of the Himalayan "hump" to move supplies into China, and construction had begun on a new road to replace the portion of the Burma Road in Japanese hands.

In the South and Southwest Pacific the Allies continued their offensives up the chain of the Solomons and along the north coast of New Guinea. General Hyakutake's Seventeenth Army, with headquarters on Bougainville, defended the Solomons, while Lt. Gen. Hatazo Adachi's newly activated Eighteenth Army, with headquarters in the Lae-Salamaua area, controlled operations in eastern New Guinea. Both armies operated under the direction of Gen. Hitoshi Imamura's Eighth Area Army, with headquarters at Rabaul. In early February 1943, the headquarters of the American Sixth Army was activated at Brisbane, Australia, with Lt. Gen. (later Gen.) Walter Krueger in command. Most of the American troops in the Southwest Pacific, including the 1st Marine Division, the 32d and 41st Army divi-

sions, the 503d Parachute Infantry Regiment, the 158th Infantry Regiment, and certain artillery and engineer organizations, were immediately assigned to this army. Soon it was to become the spearhead of General MacArthur's strategic offensive to recapture the Philippines. Adm. (later Admiral of the Fleet) William F. Halsey now commanded the South Pacific area. Ground operations in his area were to be conducted by the 14th Corps, under the command of Maj. Gen. (later Lt. Gen.) Oscar W. Griswold, which consisted of the 25th, 37th, 43d, and Americal divisions.

A detailed account of the many subsequent operations in the Solomons and along the northern New Guinea coast, which required almost all of the year 1943 to accomplish, is beyond the scope of this article. Many islands were captured, and numerous coastal leapfrog operations were conducted to isolate Japanese garrisons. These are indicated on Map 40. The importance of these operations should not, however, be depreciated; most of the positions were bitterly contested, Japanese power was severely drained, and American forces developed a skill in amphibious operations that was to serve them well in later major operations.

**Approach to the Philippines.**—As 1944 dawned, Allied advances in the Solomons and New Guinea had virtually isolated the Japanese base at Rabaul; it appeared that the dreaded assault on this strongly fortified position would not be necessary. Toward the end of 1943, tremendous gains in aircraft and naval construction in the United States had permitted the Allies to take the offensive on a large scale. In November, Admiral Nimitz' Central Pacific forces had assaulted and captured Tarawa and Makin in the Gilbert Islands, obtaining bases that could support operations against the next objective, the Marshall Islands, and from which land-based planes could pound the great Japanese base at Truk. In China during 1943, air attacks had constituted the only Allied offensive operations. With increased strength, bombers operating from Chinese bases attacked Japanese bases in Burma, Thailand, Indochina, Hainan, Hong Kong, and Taiwan. Japanese shipping along the China coast was frequently attacked with good results. In Burma seesaw ground operations between Japanese and British-Chinese troops had taken place without material advantage to either side. There also the Allies gradually came to control the air.

During 1944 the tempo of the war in both the Southwest and the Central Pacific areas accelerated with each passing month. General MacArthur projected an advance to the Philippines along the New Guinea axis, while Admiral Nimitz moved directly westward. MacArthur's plan was to take advantage of the position of the Japanese forces, separated as they were by long distances and with only sea and air communications connecting them. The island-hopping and leapfrog techniques, which had proved so successful in 1943, were well suited to the isolation or destruction of the Japanese posts ahead. By these means, General Krueger's Sixth Army was to advance more than 2,000 miles to the Philippines in the next six months. With units of the Australian First Army in the process of taking over operations in eastern New Guinea and the Solomons and blocking the Japanese at Rabaul, MacArthur had adequate troops for the contemplated operations, but he was weak in naval and

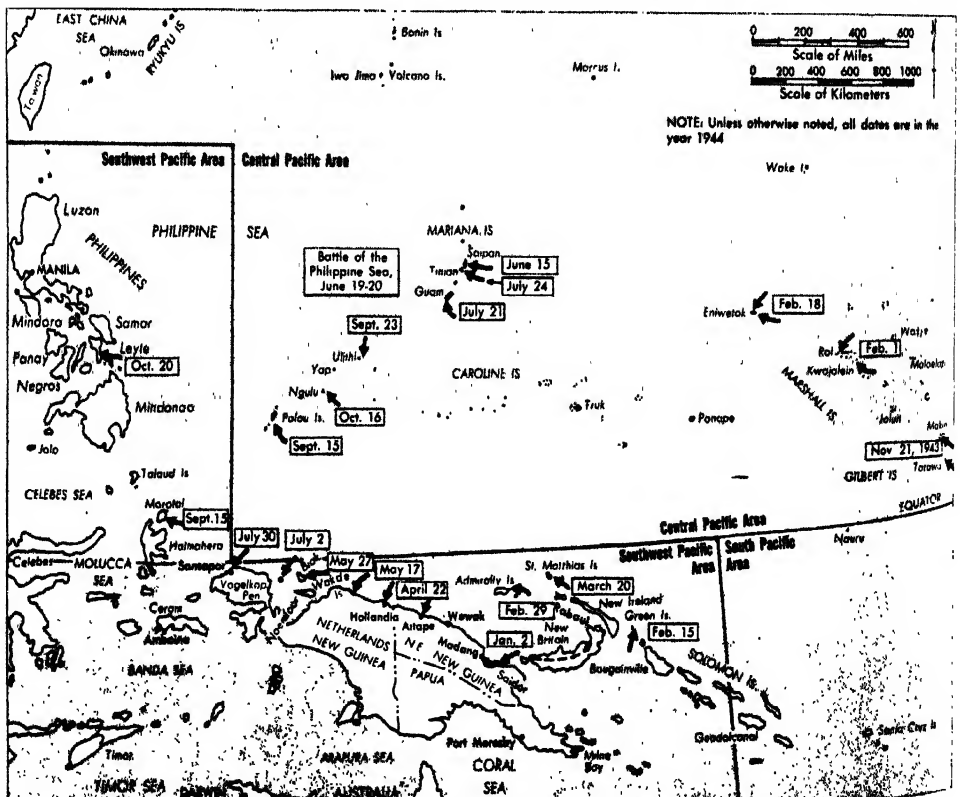
air support, particularly carrier aircraft to assist his long jumps up the New Guinea coast. Arrangements were made with Admiral Nimitz to have Rear Adm. (later Adm.) Marc A. Mitscher's Task Force 58, a large fleet strong in carriers, support MacArthur. Successive operations in both the Southwest and Central Pacific areas are shown on Map 41. By mid-September 1944, American forces were landing on Morotai Island and the Palau Islands. At the same time, Admiral Halsey's Third Fleet was launching its many carrier aircraft in attacks on Mindanao and other enemy bases in the Philippines.

**Return to the Philippines: Leyte Campaign.**—It had been the American plan to capture the outlying islands of Mindanao, Talaud, and Yap and then to invade Leyte, in the central Philippines, on Dec. 20, 1944. Indeed, Maj. Gen. (later Gen.) John R. Hodge's 24th Corps had left Hawaii on September 15 en route to Yap. On that day, Admiral Halsey reported extremely weak opposition to his carrier-air attacks in the central Philippines and recommended the abandonment of the preliminary operations and an early attack directly on Leyte. It was decided to carry out his recommendation, and the 3d Amphibious Force, carrying Hodge's troops, changed course for MacArthur's area to participate in the Leyte operations, which were rescheduled for October 20.

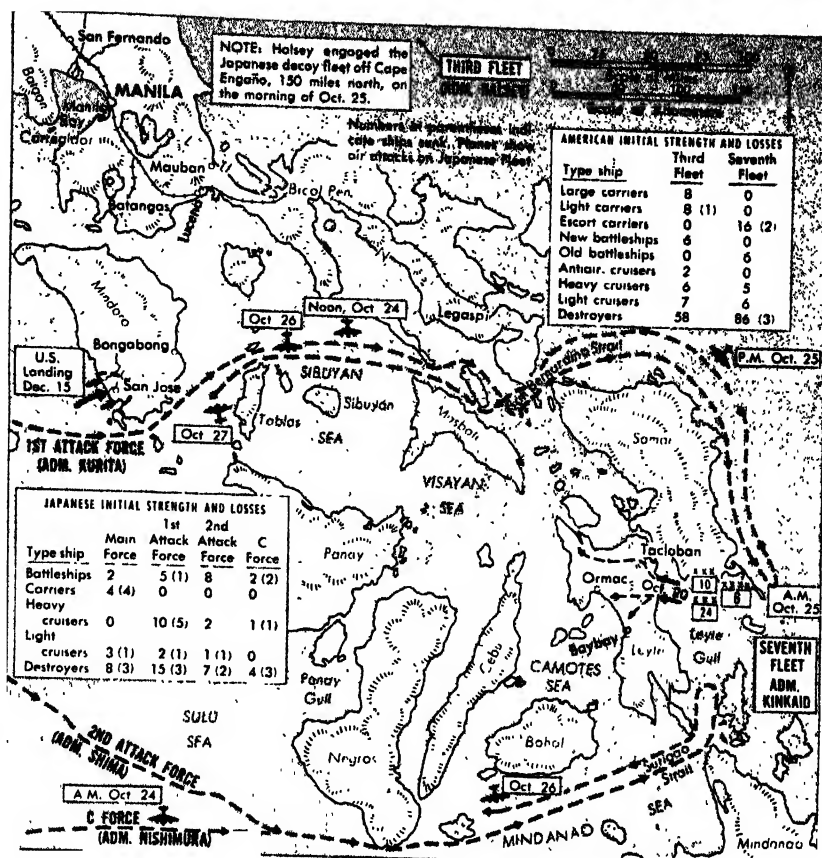
An expedition comprising more than 700 ships was assembled for the invasion. Vice Adm. Thomas C. Kincaid's greatly augmented Seventh Fleet provided the naval and carrier-air support, it was divided into Northern and Southern Attack forces. General Krueger commanded the ground troops: the 10th Corps, Maj. Gen. Franklin C. Sibert commanding, accompanied the Northern Attack Force; General Hodge's 24th Corps, the Southern Attack Force. On October 10, the Third Fleet inaugurated a seven-day air attack against Japanese bases in the Ryukyu Islands, Taiwan, and Luzon to protect the northern flank of the invasion forces. More than 100 Superfortresses of the 20th Bomber Command in China joined in the attack on Taiwan. The Third Fleet did its job of protection well, and MacArthur's forces arrived off Leyte without incident.

The defense of the northern Philippines had been entrusted to Gen. Tomoyuki Yamashita, conqueror of Singapore in 1942, and his Fourteenth Area Army. The Thirty-fifth Army, under Lt. Gen. Sosaku Suzuki with headquarters on Cebu, was charged with the defense of the central and southern Philippines. On October 20, there were 270,000 Japanese ground and air troops in the Philippine Islands. Suzuki expected that Mindanao would be the first American objective in the Philippines; hence only his 16th Division occupied Leyte. Its combat strength

Map 41. APPROACH TO THE PHILIPPINES (Nov. 21, 1943–Oct. 20, 1944). After the successful operations in eastern New Guinea and the Solomon Islands, the American forces began a two-pronged advance toward the Philippines. Adm. Chester W. Nimitz' Central Pacific forces drove straight westward; Gen. Douglas MacArthur's Southwest Pacific forces leaptfrogged along the northern New Guinea coast. Many Japanese garrisons were isolated and left to wither on the vine. These step-by-step advances are shown on the map. The first landings in the Philippines were made on Leyte Island by MacArthur's troops on Oct. 20, 1944.



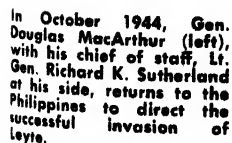
**Map 42. RETURN TO THE PHILIPPINES: LEYTE CAMPAIGN (Oct. 20, 1944-Jan. 1, 1945).** The American Sixth Army landings on Leyte on Oct. 20, 1944, surprised the Japanese and met little opposition. As at Guadalcanal, however, the Japanese poured all reinforcements available into the defense of Leyte. The ground action was particularly bitter during November, but the Sixth Army gradually forced Lt. Gen. Soseku Suzuki's troops back with appalling losses. The fighting gradually tapered off, and by Jan. 1, 1945, the American troops were in full control of the island. Early in the campaign the United States ground forces were threatened with isolation when Japanese naval forces converged on Leyte Gulf, as shown. Vice Adm. Takeo Kurita's sudden decision to turn around and withdraw probably saved the United States forces from disaster.



was 10,620 men, and it was supported by 1,000 base defense troops and 10,000 service troops. The division was no match for the four American divisions that landed on October 20, and the surprised Japanese troops withdrew to the northwestern section of Leyte.

While the Japanese were caught unprepared on the ground, this was not true of the Japanese Navy. The Combined Fleet went into action with a prearranged plan that almost turned the invasion into an American disaster. The Battle for Leyte Gulf, which took place on October 23-26,

was actually a series of major surface and air engagements, culminating in three almost simultaneous naval actions: the Battle of Surigao Strait, the Battle off Samar, and the Battle off Cape Engaño. These complex operations can best be understood by consulting Map 42. The Japanese plan was to destroy the American landing forces and supporting ships at Leyte Gulf by converging naval attacks from the north and south. The powerful Second Fleet, under Vice Adm. Takeo Kurita, was to make the converging attacks with its two subdivisions, the 1st Attack



## Wide World



Force from the north and C Force from the south. These forces were to destroy the American warships at Leyte Gulf. Vice Adm. Kiyohida Shima's 2d Attack Force (Fifth Fleet) was to follow C Force and destroy American shipping in the gulf after the warships had been eliminated. Vice Adm. Jisaburo Ozawa's Third Fleet, with 4 half-empty carriers, was to move southward from Japan to lure Admiral Halsey's superior Third Fleet from the scene of action. If it succeeded in doing so and the major American forces at Leyte were destroyed, the loss of the entire Japanese Third Fleet would have been warranted.

On October 25, C Force entered Surigao Strait from the west and was attacked by the battleships and cruisers of Admiral Kincaid's Seventh Fleet. It was virtually destroyed. The 2d Attack Force came up in the rear, engaged the Americans briefly, and then reversed course and withdrew hastily under air attack. Meanwhile, Admiral Kurita's 1st Attack Force moved through San Bernardino Strait unmolested and headed southward for Leyte. (Admiral Halsey had moved to the north to engage the decoy Third Fleet; hence the strait had been left unguarded except for land-based aircraft.) Suddenly Kurita's warships appeared before Kincaid's unprotected escort carriers and destroyers off Samar. Guns from his battleships, up to 18 inches in caliber, fired at the carriers as they attempted to escape to the southeast. It began to look as though Kurita would have a turkey shoot among the huge assemblage of cargo and transport vessels in the gulf. Then, for many reasons (none particularly valid), he turned about and retired back through San Bernardino Strait. En route his fleet was attacked and damaged by a detachment of fast battleships and carriers sent southward by Halsey. The latter had concentrated his attention on Ozawa's carriers and had succeeded in sinking all of them.

The Japanese had planned to make the main defense of the Philippines on Luzon. Now they decided to fight the decisive battle on Leyte. Reinforcements began to pour in by barge, destroyer, and transport. The 16th Division was joined eventually by five others; the 8th, 26th, 30th, and 102d divisions from other islands of the Philippines; and the crack 1st Division from the general reserve in Shanghai. Despite the loss of 1,200 planes to Halsey's Third Fleet over the air replacement route from the Ryukyu Islands to the Philippines and the destruction of more than 400 planes at the Manila airfield complex, the Japanese managed to bring in 1,000 additional aircraft. Troop reinforcement convoys were under constant attack by American planes, and thousands of troops en route to Leyte were sent to watery graves.

The crucial land fighting occurred during November. Additional American troops had been rushed to Leyte, and Krueger's Sixth Army had been increased to seven divisions. The 10th Corps, operating in the northern sector, consisted of the 24th and 32d Infantry divisions and the 1st Cavalry Division; the 24th Corps, in the southern sector, of the 7th, 77th, and 96th Infantry divisions and the 11th Airborne Division. The fighting was extremely bitter, but the Japanese were gradually forced back. On December 6-7, they made a final bid for victory with a counterattack and paratroop operations designed to capture the Burauen airfields, but were un-

successful. By Jan. 1, 1945, the Leyte campaign could be regarded as closed except for minor mopping-up operations. Meanwhile, on December 15, American troops had landed on Mindoro, just south of Luzon, to set up a base for operations against that island.

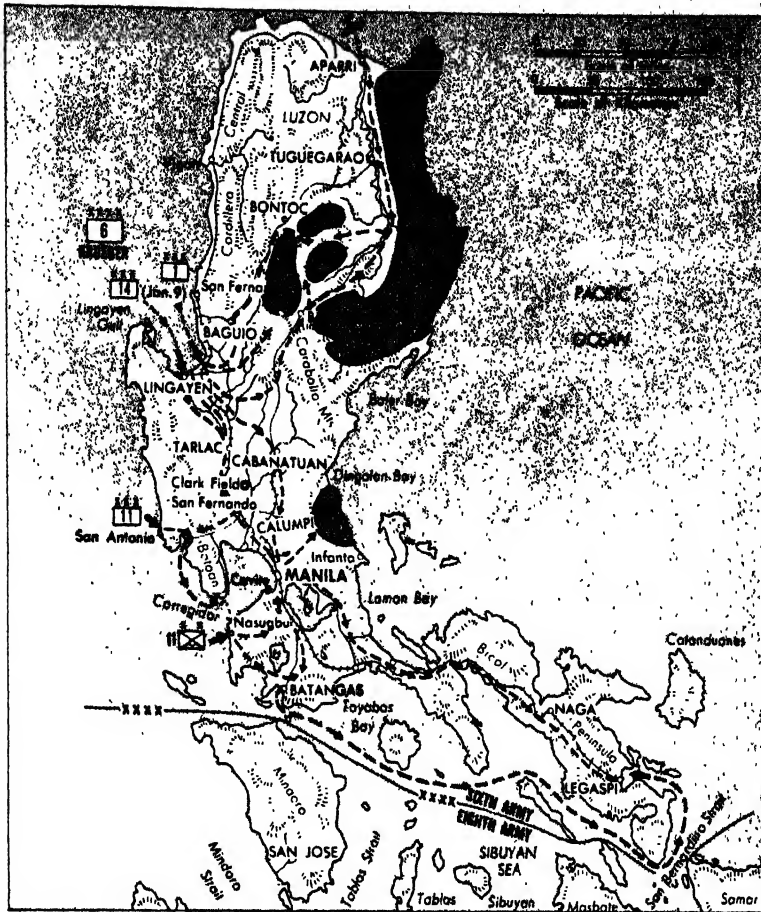
The Japanese had committed the major portions of their air and naval forces to the defense of Leyte. Both had suffered staggering losses. Their ground forces incurred about 70,000 casualties; American ground force casualties totaled 15,584.

**Liberation of the Philippines.**—During 1944 the Allies had registered major gains on all fronts except in China. There the Japanese had resumed offensive operations on a large scale, exerting every effort to make their forces in China self-sufficient. In Burma an Allied advance had cleared the route of the new Ledo Road, connecting with the Burma Road in China, and in January 1945, supplies began to move over the road into China. The British, having repulsed a major Japanese offensive earlier in the year, were now themselves on the offensive and driving toward Rangoon and Mandalay. In the Pacific the two-pronged advance of Admiral Nimitz and General MacArthur had merged in the Philippines, the outer defenses of Japan had been ruptured by the seizure of the Marianas, and Tokyo had come within range of American Superfortresses. Moreover, by the end of 1944, American submarines alone had sunk 4,300,000 tons of Japan's merchant shipping, and the Japanese were hard pressed to support their needs at home. As the year 1945 began, it was apparent that Japan had lost the war, but she would not yet admit defeat. Her forces continued to struggle with the same fanatical zeal and tenacity of purpose that had characterized their fighting in the early days of the war. While her air, ground and naval strength had been considerably reduced, strong forces for defense still remained at her disposal.

The date set for the invasion of Luzon was Jan. 9, 1945. General Krueger's Sixth Army was to conduct the operations; General Eichelberger's Eighth Army took over Leyte, Samar, and Mindoro and prepared to clear the Japanese from the islands south of Luzon. The Australian First Army was assigned the mission of eliminating isolated Japanese garrisons on New Guinea, New Britain, and Bougainville and of recapturing Borneo and its rich oilfields. The Sixth Army planned to land at Lingayen Gulf, secure the central plain of Luzon, and capture Manila. Naval and air elements would conduct demonstrations along the south coast, and guerrillas would destroy communications in southern Luzon. Admiral Kincaid's augmented Seventh Fleet, designated the Luzon Attack Force, had the mission of transporting, landing, protecting, and supporting the invasion forces. It consisted of more than 850 vessels, including 6 old battleships, 18 escort aircraft carriers, 10 cruisers, 141 destroyers, and a host of smaller craft. Admiral Halsey's roving Third Fleet was to cover the invasion force by air strikes against targets on Taiwan and northern Luzon. Lt. Gen. (later Gen.) George C. Kenney's Far East Air Forces, based on Leyte and Mindoro, would bomb targets on Luzon, and China-based Superfortresses were to hit Taiwan and targets along the China coast.

For the Lingayen Gulf landing the Sixth

Map 43. LIBERATION OF THE PHILIPPINES (Jan. 9–Aug. 14, 1945). Unsupported by the Japanese Navy and having expended practically all of his air force and many of his best troops in the futile defense of Leyte, Gen. Tomoyuki Yamashita realized that he could not defeat a determined attack on Luzon. He planned to offer what resistance he could, and then withdraw into the mountains to hold out as long as possible. The American landings were not strongly opposed, but the defense of Manila was fierce. Yamashita's Fourteenth Area Army was eventually forced into the mountains and broken into the five isolated groups shown. His troops surrendered after Japan capitulated on August 14. In the meantime, Lt. Gen. Robert L. Eichelberger's Eighth Army was cleaning up Japanese resistance on Mindanao and the other southern and central islands of the Philippines. He had his opponents similarly boxed in in the mountain areas when the war ended.



Army had Maj. Gen. (later Lt. Gen.) Oscar W. Griswold's 14th Corps (37th and 40th divisions); Maj. Gen. Innis P. Swift's 1st Corps (6th and 43d divisions); and a reserve that included the 25th Division, the 158th Regimental Combat Team, the 6th Ranger Battalion, and the 13th Armored Group. In view of the reports of great Japanese strength on Luzon, additional troops were scheduled to join Krueger later. These were the 32d, 33d, and 41st divisions, the 1st Cavalry Division, and the 112th Cavalry Regimental Combat Team.

General Yamashita's Fourteenth Area Army on Luzon aggregated approximately 250,000 men. There were only about 150 Japanese aircraft based on the island, but they were to exact a frightful toll of American shipping by suicide attacks known as Kamikaze (q.v.). These attacks began on January 4 as the American invasion fleet passed the island of Panay. By January 13, when the last of the Japanese planes had been expended, 17 American ships had been sunk, 20 had sustained major damage, and 30 had received lesser damage. Isolated and lacking air and naval support, Yamashita entertained little hope of holding Luzon, and he planned only to conduct a delaying action to prevent the fall of the island as long as possible. His forces were divided into three groups: the Shobu Group (140,000 men) in the north, to guard against an invasion through Lingayen Gulf; the Kembu Group (30,000) in the center, to protect the

Clark Field airfield complex; and the Shimbu Group (80,000), to protect southern Luzon. When forced to do so, the Japanese would withdraw into the mountains in the east and hold out there to the end.

At 9:30 A.M. on January 9, the Sixth Army landed at Lingayen Gulf with the 14th Corps on

As men of the U.S.S. *Hornet* (foreground) watch, Navy gunners bring down a Japanese Kamikaze plane.

Wide World







In the month-long fighting for Manila, American riflemen and mortar crews, dug in on the lawn of the president's residence, fire at Japanese entrenchments. The last Japanese resistance in the city was wiped out on March 3, 1945.

Wide World

the right and the 1st Corps on the left. Only light opposition was met, and by nightfall 68,000 men were ashore. While the 14th Corps made steady progress toward Clark Field, the 1st Corps encountered bitter resistance in the Cabaruan Hills, directly in its path, and in the Caraballo Mountains, on its eastern flank. The Japanese there were a threat to the American line of communications, for Lingayen Gulf would have to serve as the supply base until Manila had been captured. By January 31, the 14th Corps had seized the airfield complex in the Clark Field-Fort Stotsenburg area, but the 1st Corps was still occupied in the Caraballo Mountains. In the meantime, two subsidiary operations by Eighth Army troops had taken place. On January 29, the 11th Corps landed near San Antonio and rushed inland to seal off the Bataan Peninsula; on January 31, the 11th Airborne Division landed at Nasugbu and headed for Manila.

Krueger now organized elements of the 14th Corps into flying columns for a dash on the capital. By February 3, American troops had reached the outskirts of Manila, but it would take a month of stern fighting before the city could be cleared. Although Yamashita offered stubborn resistance in the mountains, he was pushed back steadily. By March 15, his forces had been broken into three separate groups, but he held out until Japan surrendered on August 14.

Meanwhile, Gen. Eichelberger's Eighth Army methodically set about eliminating Japanese resistance in the central and southern islands. By August 14, the greater part of the organized resistance had been wiped out, and the main Japanese forces on Mindanao were deep in the mountains of the interior, where they faced starvation. The Japanese lost more than 170,000 known killed on Luzon; American casualties were approximately 38,000, including about 8,000 killed.

**Collapse of Japan.**—Even as American forces were fighting in the Philippines, on Iwo Jima, and on Okinawa, preparations were being made for the invasion of the Japanese homeland. The Japanese surrender on August 14 fortunately made it unnecessary to conduct this admittedly hazardous and costly undertaking.

The final phases of the war are described in sections 10. *War in the Central and Northern Pacific* and 11. *War in Eastern Asia*. See also

section 14. *Diplomatic History*; separate biographies of the leading military commanders; articles on areas in which the principal engagements were fought; JAPAN—22. *Foreign Relations (1931–1945)*; PHILIPPINES—History.

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## 10. War in the Central and Northern Pacific

**Navies of Japan and the United States.**—A maritime war necessarily followed the breakdown in December 1941 of peaceful relations between the United States and Japan (see section 14 *Diplomatic History*). Poor in resources, Japan required the mineral wealth of the Dutch and British possessions to the south if she were to achieve her national aim, the domination of East Asia. To check Japan the United States had to project her power 6,000 miles across the Pacific Ocean. After initiating the conflict, Japan moved so far so rapidly that she soon accomplished her goals and threatened Australia. The axis of movement of United States forces during the first two years of the Pacific war therefore had to be directed to the southwest rather than to the west, as had been planned. Thrown on the defensive by the attack on Pearl Harbor, the United States Navy was barely able to protect the vital line of sea communications to Australia. When the offensive phase finally began for the United States, that nation found itself with the choice of two campaigns, one across the Central Pacific and the other from the South Pacific back along the route that the Japanese had taken. Whatever the choice, all major movements would be made over-water. Command of the sea was essential, and the nation whose navy gained control of the waters of the Western Pacific would be victorious.

The size of the two navies that would be the determinants in the Pacific struggle had been set at the Washington Conference of 1921–1922. For Japan a war in the Pacific would probably be fought against the United States, with its aim being a negotiated peace that would leave Japan a free hand in East Asia. This could be achieved by a strategic defense with a navy two thirds as large as that of the United States. The size assigned to Japan by the Washington Con-

ference was 60 percent, which Japanese officers claimed was not sufficient. They therefore built ships superior to those of the United States in firepower and speed at the expense of livability and radius of action. Japan's two largest battleships, the *Yamato* and the *Musashi*, each mounted nine 18-inch guns; she possessed a greater number of aircraft carriers than did the United States; aircraft, torpedoes, and equipment for night fighting were superior; and ship's companies were superbly trained. Tactical plans called for the enemy to be reduced by attrition and then destroyed in a major fleet action.

The United States Navy entered the war weak in some elements and strong in others. Ordnance was inferior, but its system of high-pressure steam propulsion was the best in the world. Its Marine Corps had the potential to seize the bases needed, and its train of auxiliaries, which for two decades had supported the fleet while at anchor in the San Pedro-San Diego area of California, became the nucleus for the mobile type of support that would characterize sea, air, and ground operations in the Pacific.

Merchant shipping would be the major weakness of both nations. The United States did not require a large merchant marine in peace and thus had to build one in war. The Japanese possessed a sizable merchant fleet, but it was forced to do a double job: bring in food and raw materials for a war economy and support military operations overseas.

When the war started, the United States had 17 battleships, 6 aircraft carriers, and 32 cruisers, distributed about equally between the Atlantic and the Pacific. The Japanese had 10 battleships, 9 aircraft carriers, and 46 cruisers, all stationed in the Western Pacific. Numbers of other types of warships were in approximately the same proportions.

The officers of the Japanese Navy were dedicated to their profession, and they drove themselves and their men hard. Training was tough and realistic, and loss of life was accepted as it would be in war. Although admiring the United States and personally friendly toward its Navy, they thoroughly studied this prospective enemy. English was their second tongue, and the most promising officers were sent on attaché duty to Washington. The officers and men of the United States Navy reflected the merits and faults of their countrymen. They were unique, however, in a way of life that combined devotion to duty with a spartan ability to live continually in their warships. Their major weakness in 1941, a grave one indeed, was a lack of appreciation of the strength of their probable enemy. Because of this, many United States sailors would die, and all would suffer a humiliation especially bitter to the proud.

In support of the national policy, Japanese naval planning provided for a quick seizure of Dutch and British possessions in Southeast Asia. The United States was to be held off by a chain of island defenses across the Western Pacific. For this purpose the Kuril, Mariana, and Caroline islands were already in Japanese hands, but the islands on the southern end of the chain, mandated to Australia and New Zealand, would have to be seized.

United States war planning had to provide for the defense or recapture of the Philippines with a step-by-step movement across the Pacific. Naval officers realized the dangerously exposed position

of the United States in the Far East, and they rankled under the provision of the Washington Conference that forbade the development of bases in American Far Eastern possessions. United States war plans were sound in principle but weak in detail. They were not supported by adequate intelligence, their timing schedule was too optimistic, and logistics were neglected. The last-named deficiency was revealed when the fleet was based on Pearl Harbor in 1940, and an overseas supply activity had to be established at Oakland, Calif.

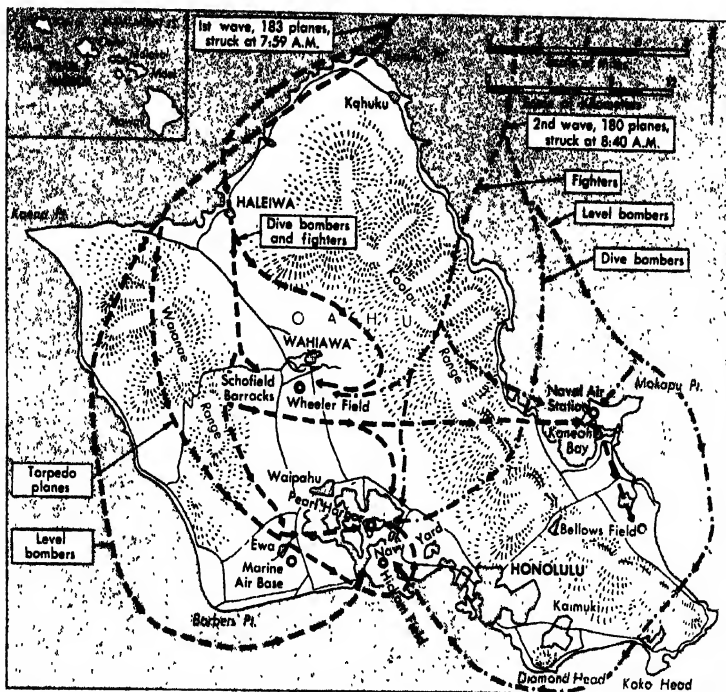
**Pearl Harbor.**—The oil of Borneo and Sumatra 5,000 miles away, brought about the attack on Pearl Harbor. In July 1940, the United States placed an embargo on the export of oil and scrap metal without a special license and of all aviation gasoline to Japan. When Japanese forces moved into northern French Indochina in September, the United States reacted with an embargo on scrap iron and steel, and when they also moved into southern Indochina, in July 1941, all Japanese assets in the United States were frozen. Similar action by Great Britain and the Netherlands affected shipments of oil from the East Indies. This created such a critical situation for Japan that its cabinet decided that, unless the United States made concessions, the oilfields to the south would be seized by military operations.

The plan of the Japanese Navy's General Staff was to employ the navy's entire air and surface strength in a direct thrust southward, quickly secure its objectives, and then turn its attention to the Western Pacific, where an advancing United States Fleet would be dealt with as the Russians had been at Tsushima in 1905. Adm. Isoroku Yamamoto, commanding the Japanese Combined Fleet, had a different plan. He believed that the United States Pacific Fleet would have to be destroyed in the first year of the war before it could be strengthened by the building program then in progress. His plan called for a carrier air attack on this fleet at its base in Pearl Harbor as the opening act of the war, while the advance to the south would be supported primarily by land-based aircraft. When a test of the plan on a game board predicted heavy losses, the Navy General Staff opposed it, but the popular Yamamoto forced its acquiescence by a threat of resignation.

A force composed of Japan's 6 largest carriers, 2 fast battleships, 2 cruisers, and a number of destroyers and tankers, commanded by Vice Adm. Chuichi Nagumo, was assigned this task. The carriers' air groups received special training. Aircraft torpedoes were equipped with ailerons to enable them to be used in the shallow depth of Pearl Harbor, and fins were fitted to armor-piercing shells to convert them to bombs.

The task force assembled in secrecy at Takan (now Hitokappu) Bay on Etorofu-to (now Iturup Island) in the Kurils and departed for its mission on November 26<sup>1</sup>, proceeding eastward in northern latitudes. It observed radio silence, and no shipping was encountered. The passage was rough, and destroyers had to be sent back, but carriers, battleships, and cruisers reached the launching point about 200 miles north of the Hawaiian Islands at 6 A.M. on December 7. Earlier a force of 16 fleet-type submarines had been deployed off Pearl Harbor, where 5 of them launched midget submarines. Two of the midgets succeeded in getting inside Pearl Harbor on December 7,

<sup>1</sup> Dates in all cases are those of the area in which events occurred.



Map 44. JAPANESE ATTACK ON PEARL HARBOR (Dec. 7, 1941). In a military sense the Japanese attack on Pearl Harbor was well conceived and brilliantly executed. It put the United States Pacific Fleet out of action long enough to permit attainment of the primary objective, conquest of the Southern Regions. But the Japanese were content with half a victory. They failed to destroy the vulnerable maintenance facilities and oil storage or to assault and occupy the Hawaiian Islands, both of which courses were feasible. These derelictions were to allow the United States Navy to recover and enter the fray much sooner than the Japanese expected.

but were sunk. One grounded on the north coast of Oahu, and its two-man crew was captured; the others did not return to the recovery area. This entire submarine effort accomplished nothing.

The warships of the Pacific Fleet at Pearl Harbor on the morning of December 7 included 8 battleships, 9 cruisers, 29 destroyers, 5 submarines, and a number of auxiliaries. One fourth of their anti-aircraft batteries were manned. Fortunately for the United States, no carriers were present. The *Saratoga* was still being overhauled on the west coast, while the *Lexington* and the *Enterprise* with their task forces were at sea ferrying aircraft to Wake and Midway Islands.

The first wave of attacking Japanese aircraft, launched at 6 A.M., was composed of 183 dive bombers, level bombers, torpedo planes, and fighters. This group encountered no search aircraft in its two-hour approach and was barely sighted before the first bombs were dropped. It was detected by a United States Army radar operator, but the officer whom he informed decided that the aircraft were friendly. The attack began at 7:59 A.M. with dive bombing on the airfields. Torpedo planes then attacked the 7 battleships moored to concrete quays on the northwest side of Ford Island in Pearl Harbor. Heavy bombers followed. Only 4 United States aircraft got off the ground, and these were soon shot down. Japanese fighters, having no opposition, strafed the closely packed Army Air Forces (AAF) planes, which had been lined up for easier protection against sabotage, the supposedly major threat. The second wave of 180 aircraft struck at 8:40 A.M. Its pattern of attack was similar to that of the first wave, except that it launched no torpedo planes.

By this time the ships' anti-aircraft batteries were firing, and these brought down the only Japanese aircraft lost by gunfire. The attack was over by 9:15 A.M., and before 1 P.M. all surviving Japanese aircraft had returned to their carriers.

Only 29 planes, with their crews of 55 officers and men, were missing. Of the American battleships, the *Arizona* was completely destroyed, the *California* and *West Virginia* were sunk, the *Oklahoma* capsized, the *Nevada* was heavily damaged, and the *Pennsylvania*, *Tennessee*, and *Maryland* were damaged but able to proceed under their own power to the west coast. In addition, 3 cruisers were damaged, 2 destroyers burned and heavily damaged, and 2 auxiliaries sunk and 2 damaged. Personnel casualties were heavy, 2,403 men losing their lives in the first hour of the war.

More words have been written about the Pearl Harbor disaster than perhaps about any other single event in United States history. The official investigations alone fill 39 volumes. Nevertheless, Americans continue to ask "Why?" An answer is found in Roberta Wohlstetter's *Pearl Harbor, Warning and Decision* (Stanford, Calif., 1962). Contributing causes were invalid assumptions, faulty appraisal and dissemination of intelligence, and inadequate security measures. Behind these was a lack of war-mindedness at this Pacific base halfway around the world from areas where momentous events were happening. Adm. Husband E. Kimmel, the Pacific Fleet commander, admits to it: "We did not know that in the Atlantic a state of undeclared war existed" (*Admiral Kimmel's Story*, p. 2, New York 1955). The War and Navy departments also shared in responsibility for the disaster, not only by withholding intelligence but by assigning low priorities to critical equipment for ships and units in the Hawaiian area.

For Americans, Pearl Harbor was a disgraceful tragedy. For Japan it was a brilliant tactical victory, a temporary strategic success, a lost opportunity, and, in the end, a colossal political mistake. By sinking the battleships but not the carriers, the Japanese Navy resolved a long-standing argument among United States naval officers as to which type would comprise their capital ships. The

American people were aroused as they would not have been had the plan of the Japanese Navy's General Staff been adopted. The lost opportunity was Nagumo's failure to destroy with a second strike the Pearl Harbor base facilities, especially the exposed and fragile tanks that contained 4,500,000 barrels of precious oil. The destruction of these tanks would have sent the Pacific Fleet back to the west coast, might have starved Hawaii, and would certainly have broken the line of sea communications to Australia. Instead a prostrate United States Navy was allowed to recover at Pearl Harbor.

**Battle of Midway.**—Within hours after the Pearl Harbor attack the Japanese struck at the Philippines and Malaya, and for the next five months success followed success. By splendid preparation and planning the Japanese armed forces achieved their initial goals so quickly that they soon were confronted with the problem of what to do next. The offensive had to be retained, and the choice made was an advance toward Australia. Since the Japanese Army, with an eye on a weakened Soviet Union, would not release sufficient troops for an invasion of Australia itself, the plan was to occupy New Guinea, New Caledonia, and Fiji. This South Pacific advance was getting started when the Doolittle raid took place.

On April 18, 1942, 16 specially equipped B-25 AAF Bombers under Lt. Col. (later Lt. Gen.) James H. Doolittle took off from the carrier *Hornet*, 650 miles east of the Japanese islands, and made a raid on Tokyo. Most of the planes reached safety in China. Results were meager, but the Japanese believed that these aircraft had come from Midway. This atoll and the western Aleutians remaining in United States hands thus constituted a threat to the homeland, and the line of Japanese-held bases would have to be extended to include them. Yamamoto had always favored a campaign to the east, and he hoped by such a movement to bring out the remainder of the United States Pacific Fleet to battle. After his success at Pearl Harbor, the Navy General Staff could refuse him nothing, and despite the southern advance an order to capture Midway and occupy the Aleutians was issued on May 5. A force of 5 carriers and 11 battleships with 5,000 troops was to strike Midway on June 4, while another force (which included 2 carriers) was to support the Aleutian occupation. A submarine line was to form west of the Hawaiian group on June 1 to report any approaching United States forces.

Yamamoto believed that 2 United States carriers instead of 1 had been lost in the Battle of the Coral Sea on May 8, and he assumed that the 2 others were still in the South Pacific. He did not know that Adm. (later Admiral of the Fleet) Chester W. Nimitz, who had relieved Kimmel, was reading his messages. The 3 United States carriers were recalled, the damaged *Yorktown* was quickly repaired, and by June 1 all of them were at sea beyond the Japanese submarine line. Rear Adm. (later Adm.) Raymond A. Spruance commanded the *Enterprise* and *Hornet* group. Rear Adm. (later Adm.) Frank J. Fletcher with the *Yorktown* group was in tactical command, but Nimitz at Pearl Harbor retained over-all control.

On June 3, the Japanese carriers with the Aleutian force struck Dutch Harbor on Amaknak Island, and landings were made on Kiska

and Attu on June 6-7. A cruiser-destroyer-submarine force sent by Nimitz to check this strike never made contact with the Japanese.

The Japanese Midway force remained undetected until June 3, and its carrier group, which included the large carriers *Akagi*, *Kaga*, *Soryu*, and *Hiryu* and was still commanded by Nagumo, reached the launching point 240 miles northeast of Midway, at 4:30 A.M. on June 4. The first wave, composed of 108 planes, was reported by a United States patrol plane at 5:45 A.M. At 6:30 A.M., it struck Midway. Damage was heavy, but the group commander reported that another strike would be necessary. The second wave had been readied for a carrier attack if any United States carriers were discovered. Nagumo had sent out only a 7-plane search that morning. Hearing nothing from it by 7:15 A.M., he ordered the planes of the second wave to the hangar decks, where torpedoes would be exchanged for bombs while the first wave was being recovered. At 7:23 A.M., a cruiser plane reported American ships and, at 8:20 A.M., announced that one of them was a carrier. Nagumo decided to recover his planes first and then launch a heavy strike against the carrier at 10:30 A.M. The carrier sighted was the *Yorktown*; the faulty morning search left the *Enterprise* and the *Hornet* undiscovered by the Japanese all day.

The American commanders had the reports of the patrol plane and the attack on Midway. Since the *Yorktown* was still recovering the planes of her morning search, Fletcher sent the other two carriers toward the enemy. Spruance decided to close in for an hour to bring the enemy well within his combat range and perhaps to catch him refueling. At 7:30 A.M., Spruance launched his planes, and the *Yorktown* air group followed at 8:30 A.M. The

**Map 45. BATTLE OF MIDWAY (June 3-6, 1942).** The arrowheads show the locations of the elements of the United States and Japanese navies at midnight on June 3-4, the eve of the Battle of Midway. The Japanese forces (A-H) were as follows: A—main carrier force; B—main battleship forces; C and D—covering groups for the Midway occupation group (E); and the forces engaged in the Aleutians (F—second carrier force, G—Kiska occupation force, and H—Attu occupation force). These forces aggregated 4 large carriers, 4 light carriers, 2 seaplane carriers, 11 battleships, 12 heavy cruisers, and a host of lesser vessels. The American carrier force (J) and cruiser-destroyer task force (K), the only United States groups in the area, could muster in major vessels only 3 large carriers and 7 heavy cruisers. In view of this disparity in strength, the American victory at Midway, as described in the text, was truly remarkable.



*Enterprise* and *Hornet* air groups had difficulty in locating the enemy, and *Hornet* dive bombers missed the Japanese ships altogether. The remainder of the early launching reached the enemy at about the same time as the *Yorktown* planes.

While the Japanese had no radar, from the number of planes reported Nagumo knew that more than one enemy carrier was present. The United States torpedo planes struck first, but they were slaughtered by enemy fighters without any of their torpedoes' hitting; only 6 of the 41 torpedo planes returned to their carriers. Their martyrdom was not in vain, for the Japanese fighters could not again gain altitude, and the carrier lookouts barely had time to scream "Helldivers" before the bombers struck and roared away. Between 10:20 and 10:25 A.M., three bombs hit *Akagi*, one exploding on the hangar deck; four hit *Kaga*, two on the hangar deck; and three hit *Soryu*, one on the hangar deck. Gasoline caught fire, bombs and torpedoes exploded, and within 20 minutes these carriers were burning wrecks. All were gone by the next morning. The rest was anticlimax. Dive bombers from the *Hiryu* hit the *Yorktown* at 12:20 P.M., and two torpedoes struck her at 2:30 P.M. She was abandoned soon thereafter. The *Hiryu* herself was eliminated at 5 P.M. by dive bombers from the *Enterprise*.

Yamamoto was still confident because he believed that the disabled American carrier was the only one present. He recalled the Aleutian carriers, and at 7:15 P.M. ordered his surface force to move in for the kill. Two hours later, Nagumo enlightened him, and at 2:55 A.M. on June 5 he reluctantly ordered a general retreat. Shortly thereafter, the heavy cruisers *Mogami* and *Mikuma* collided while avoiding a United States submarine. Seriously damaged, they both fell behind. On the night of June 4, Spruance headed eastward to avoid enemy surface contact, and the next day his planes did not sight the enemy. On June 6, carrier planes finished off the *Mikuma*, but the battered *Mogami* returned safely to Truk in the Carolines. The last casualty was the abandoned *Yorktown*, still afloat with a destroyer alongside. Both ships were sunk by a Japanese submarine.

The question may be asked how a fleet of such size could be turned back by the meager force that the Americans were able to bring against it. The reason was the overconfidence of the Japanese. Too many objectives had been undertaken, and too many assumptions had been made in their own favor. The submarine line was established too late, and the morning search on June 4 was inadequate. On the United States side, there were superior intelligence and good luck as well as the dive bomber. This weapon, which the Americans had developed and the Japanese copied, settled the issue in five fateful minutes. Midway was a decisive battle, for the Japanese Navy never again gained the offensive.

**Advance Through the Gilbert, Marshall, and Mariana Islands.**—The task of halting and reversing the Japanese advance in the South Pacific and the need to build up United States forces caused a lull in operations in the Central Pacific for more than a year after Midway. The one exception was the recapture of Attu in the Aleutians. Since there were insufficient forces available to take the easterly and more strongly

held Kiska, it was bypassed for Attu, where the poorly prepared 7th Infantry Division was landed on May 11, 1943. This small island was secured in three weeks, but only after 11,000 men had been landed and the Japanese garrison wiped out. On August 15, a properly equipped and trained force of Americans and Canadians landed on Kiska, but they found that the Japanese had already evacuated the island.

By the autumn of 1943 the Americans were ready to begin their strategic offensive. The geography of the Pacific offered them two directions of advance, both of which were adopted. One led along the north coast of New Guinea toward the Philippines; the other, directly across the Pacific from Hawaii. Both advances would bypass the Caroline Islands, believed to be strongly held by the Japanese. The Southwest Pacific campaign was to be conducted primarily by army forces, which would advance in shore-to-shore amphibious movements. The campaign in the Central Pacific would be primarily naval, supported by ground forces consisting mostly of Marines. It would require long overseas amphibious movements and heavy troop assaults on a few strongly held positions.

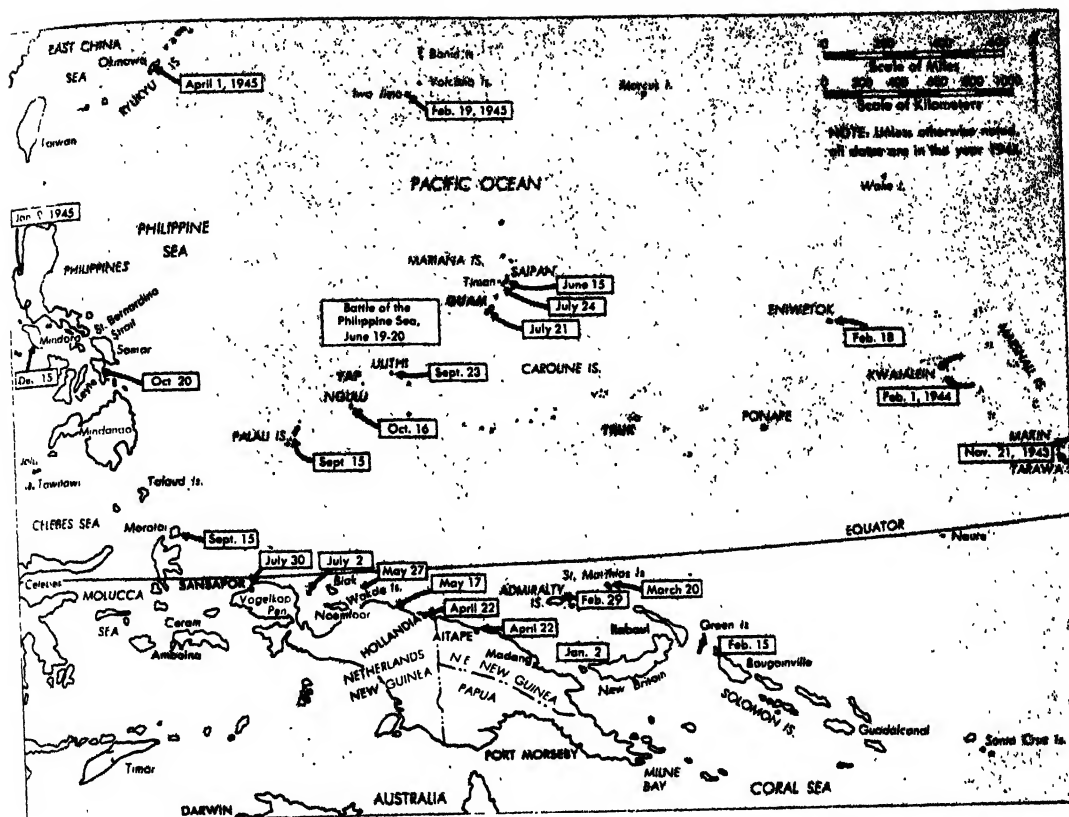
The major striking arm in the Central Pacific was a force of 16 heavy and light carriers with accompanying fast battleships, cruisers, and destroyers. Commanded by Rear Adm. (later Adm.) Marc A. Mitscher, it was named Task Force 58. Even this strong force, it was at first believed, would not be able to withstand attacks by land-based aircraft operating from the numerous Japanese-held islands in the Pacific. Early in each operation the carrier force would have to be relieved by its own land-based aircraft, and this would necessitate a step-by-step advance, first through the Gilbert Islands, then through the atolls of the Marshall Islands, and finally through the Marianas, which included captured Guam.

The Central Pacific campaign opened on November 21 with landings on Makin and Tarawa in the Gilbert Islands. At Tarawa the 2d Marine Division encountered the coral beaches and suicide resistance that would characterize Central Pacific assault operations. Casualties totaled 3,000, one third of them killed in three days of bitter fighting. This costly experience brought about improved amphibious techniques. It also revealed that the threat of enemy land-based aircraft was not as strong as had been supposed, and that naval forces could remain in the area of their objectives for extended periods without extreme risks.

Nimitz therefore decided to bypass the eastern Marshalls and seize Kwajalein. This was accomplished on Feb. 1-8, 1944, without committing the 10,000 troops of the reserve. These were used to take Eniwetok, the largest of the western Marshalls, but before this was attempted, the Japanese air bases in the Caroline and Marshall Islands were neutralized. Three carrier groups of Task Force 58 struck Truk in the Carolines on February 17-18, sinking 39 ships and putting 270 planes out of action. A strike against the Marianas on February 22 netted 150 more planes and valuable photoreconnaissance. Eniwetok, first scheduled for capture in May, was secured on February 18-23.

The assault on the Marianas was not scheduled to take place until June, and assault and





Map 46. ADVANCE ACROSS THE PACIFIC (Nov. 21, 1943–April 1, 1945). Initially, all American resources in the Pacific had to be employed to stop the Japanese advance in the Solomon Islands and eastern New Guinea. By late 1943 the tremendous production feats of United States industry provided sufficient resources for Adm. Chester W. Nimitz' Central Pacific forces to permit them to take the offensive against the Gilbert Islands. Thereafter, the forces of Nimitz and Gen. Douglas MacArthur converged in a two-pronged offensive across the Pacific, as shown. To avoid heavy losses of the kind suffered at Tarawa, such strongly fortified Japanese bases as Truk and Yap were bypassed and isolated.

amphibious forces returned to the Hawaiian Islands for training and staging. Task Force 58, however, with its afloat logistical support now in the anchorage at Majuro in the Marshalls, remained in the Western Pacific, supporting Gen. (later General of the Army) Douglas MacArthur's invasion of Hollandia, New Guinea, in April.

The Japanese mobile forces had not reacted to the Gilbert and Marshall advances. They withdrew first from Truk to the Palau group and then to Tawitawi in the Sulu Archipelago of the Philippines. The first Combined Fleet commander, Yamamoto, had been shot down on a flight to the Solomons a year before. His successor, cautious Adm. Mineichi Koga, was himself lost in an airplane accident in March 1944. The new fleet commander, Adm. Soemu Toyoda, took over with orders to seek action under favorable circumstances. Believing that the Americans were committed to the single line of advance through the Southwest Pacific, he stationed a surface force in the Moluccas and concentrated his land-based aircraft and submarines to cover it. He hoped to draw Task Force 58 into the area.

Instead the Central Pacific Fleet (now the Fifth Fleet) under Spruance struck the Marianas. Amphibious forces under Vice Adm. (later Adm.) Richmond K. Turner, numbering

555 ships, lifted 170,000 troops from the Hawaiian and Solomon Islands. The first landings were made at Saipan on June 15, 20,000 men being put ashore on that day. As at Tarawa, they met stiff resistance. Saipan was the strong link in the defense chain of the Japanese, and they were determined to hold it.

On learning of the Marianas attack, Toyoda ordered his surface and rebuilt carrier force to concentrate at sea east of the Philippines. United States submarines off Tawitawi and in the San Bernardino Strait reported this approach, and Mitscher wanted to advance with Task Force 58 to meet the Japanese and be within easy striking range at dawn of the day of contact. He knew that the enemy's striking range was 300 miles, whereas his own was only 200 miles because of the armor and self-sealing tanks in American aircraft. Spruance refused to permit Mitscher to adopt this course, since such an advance might uncover the ground and amphibious forces. The Japanese therefore had the offensive and attacked in four raids throughout daylight of June 19. To meet them, Mitscher put every available fighter in the air, and then launched his other planes to keep the carrier decks clear for rearming and refueling. With excellent fighter direction, the Japanese raids were met from 50 to 70 miles beyond the task force. There then took place what has



A battle-weary Marine quenches his thirst during the hard fighting for Saipan (June 15-July 9, 1944).

become known in the United States Navy as the "Marianas Turkey Shoot." Of the 326 Japanese planes attacking, 227 were lost, as compared with an American loss of 26. Only 3 United States ships suffered minor damage. In the midst of the Japanese flight operations, United States submarines hit 2 of their 3 largest carriers; both caught fire and sank that afternoon. The Japanese retreated, followed by Task Force 58, but contact was not made until 4 p.m. on June 20 at extreme range. Mitscher sent off one raid of 216 aircraft, which sank the carrier *Hiyo* and damaged 4 other ships. This ended the battle, and the Japanese carrier force was finished for the rest of the war.

On Saipan the 2d and 4th Marine divisions and the 27th Infantry Division, numbering 59,000 men, secured the island by July 9 after hard fighting in which they suffered 13,000 casualties, 3,000 of them killed. The Japanese defense force, which comprised 30,000 army and naval landing troops, was virtually wiped out. After heavy bombardment by army artillery and naval gunfire, nearby Tinian was taken easily between July 24 and August 1. The landings for the recapture of Guam, largest of the Marianas, had to be postponed on the approach of the Japanese Fleet, but were finally made by the 3d Marine and 77th Infantry divisions on July 21 after 11 days of intensive bombardment. The island was secured by August 10.

The seizure of the Marianas, which cracked the Japanese defense line, was the beginning of the end for Japan. The elimination of the Japanese carrier-based air strength uncovered the Philippines for MacArthur's forces, and the following November saw the first B-29 raids. A naval base was established on Guam, and Nimitz transferred his headquarters there. Spruance and his staff returned to Pearl Harbor to

plan future operations, while Adm. (later Admiral of the Fleet) William F. Halsey, former commander of the South Pacific area, assumed command of the Third Fleet, which was to work with MacArthur in the invasion of the Philippines. The Japanese and most Americans believed that the Third Fleet was another naval force, but only the top commands had changed. The ships with their splendid engineering plants were the same.

**Submarine Campaign.**—A submarine's ability to submerge makes it a unique weapon in naval warfare. It employs stealth and therefore cannot easily be integrated into naval tactical formations. It must operate alone or with its own class, whether employed against combat ships or against merchant shipping. The Japanese used their submarines almost exclusively against combat ships but the United States submarine effort was directed primarily against merchant shipping and in effect constituted a blockade of Japan.

The United States submarines employed in World War II were mostly of the *Gato* class, the 1941 design displacing 1,525 tons on the surface, 311 feet long, with a surface speed of 20 knots and a cruising radius of 12,000 miles. They were armed with 24 torpedoes with six tubes forward and four aft and a 3-inch gun and four machine guns, and they had good radar, sonar, and optical equipment. Their complement was 8 officers and 80 men. Submarines of this class were excellent ships, but their primary weapons, torpedoes, were inferior to those of the Japanese, and many were found defective as a result of faulty peacetime testing procedures. The faulty torpedoes had been fitted with magnetic exploders that would not explode. It was eventually discovered that the torpedoes were running too far below their depth settings to activate magnetically, but when this was corrected the exploders began firing prematurely in latitudes near the equator. When the magnetic feature was deactivated, the mechanical exploders failed to work. Finally a resourceful commander conducted his own field test on a tanker that he had disabled off Truk. Of 15 torpedoes used, 9 failed to explode after careful checking and under ideal firing conditions. He saved his last torpedo to take back to Pearl Harbor for evidence. Exhaustive tests conducted there disclosed the defects and in September 1943, 21 months after the commencement of the Pacific war, the first fleet-type submarine went to sea with torpedoes in which her crew had confidence.

Following the Pearl Harbor attack, the chief of naval operations issued orders for unrestricted submarine warfare. This was a change in American traditions and doctrine, which had required submarines to be used in accordance with international law and primarily against combat ships. Whatever the reasons for the change, it was a militarily sound decision, for Japan's vital arteries were her sea lines of communications from her resources areas.

At the outbreak of hostilities, 28 submarines were attached to the Asiatic Fleet. These accomplished little against the Japanese initial advance into Southeast Asia, but in 1942 submarines based on Australia and at Pearl Harbor began their relentless campaign against the Japanese supply lines. At the beginning of the war, Japan had 6,100,000 tons of shipping, and she acquired an additional 800,000 tons by captures. The total was constantly reduced, slowly until

December 1943 and then sharply, until by 1945 it had been cut to 1,800,000 tons. Most of the ships that remained were in the Sea of Japan, which was still closed by mines to United States submarines. The attrition of Japanese shipping caused shortages in raw materials, slowing industrial production. Shortages in aviation gasoline curtailed pilot training, and a major portion of the fleet had to be based in Southeast Asia, near the oilfields but at a distance from repair and training facilities. (United States submarines had sunk 110 tankers.)

Japanese antisubmarine methods were inept. Merchant ships sailed singly until 1942, and convoys remained small throughout the war. United States submarine attack groups, called wolf packs, seldom had to exceed 4 ships. Commanders adopted hazardous tactics, attempting difficult shots and often operating on the surface at night in order to make use of high speed for continuing attacks. At first the submarines had little success against combat ships. During the first two years they sank only 1 heavy cruiser, 1 light cruiser, 6 destroyers, and 3 submarines. The heavy cruiser *Kako*, returning from victory at Savo Island in 1942, was sunk by the lowly S-44, a World War I type using old-style torpedoes with simple contact exploders. In the advance across the Pacific, Spruance skillfully employed submarines by placing them in narrow waters through which the enemy would have to pass. He left the actual direction of their operations to Vice Adm. Charles A. Lockwood, commander of submarines in the Pacific, the man who had solved the problem of the faulty torpedoes. Submarines now began to obtain good shots and transmit accurate information on enemy movements. The submarine contribution to success in the battles of the Philippine Sea and Leyte Gulf in 1944 was large. In November of that year, United States submarines sank the battleship *Kongo* north of the Philippines and the giant carrier *Shinano* in the Inland Sea, the latter only 10 days after she had been commissioned.

Submarines also performed lifeguard service, recovering 504 aviators downed in carrier strikes or B-29 operations. Among other special missions were mining, reconnaissance, and contact with coast watchers, guerrillas, and other isolated groups. A total of 52 United States submarines were lost during the war. Despite poor Japanese antisubmarine methods, more were sunk by escorts than by patrols, mines, aircraft, and other means; 3 were sunk by their own countrymen.

Throughout the war the Japanese used their submarines poorly. A single exception occurred in 1942 in the early Solomons campaign, when they sank the carrier *Wasp* and 4 other ships and damaged a battleship and another carrier. For some reason they limited their submarine operations primarily to combat ships, never learning, or refusing, to use them against the long and vulnerable United States supply lines. Attempts to integrate submarines into the Pearl Harbor and Midway operations proved fruitless, and in the late days of the war, when submarines might have defended the homeland, they had to be used to feed or evacuate garrisons isolated by the United States leapfrog strategy. The Japanese Army built submarines of their own for this purpose. Improved United States antisubmarine methods, the product of experience in the tough battle of the Atlantic, caused heavy Japanese submarine losses late in the war. Of 27 sub-

marines sent out during the Marianas campaign, 17 were sunk. In May 1944, the destroyer escort *England* accounted for 7 in 10 days.

In numbers, Japanese submarines about equaled those of the United States, and their torpedoes were far superior. Sound gear was poor, they had no radar, and the morale of their crews did not match that in United States submarines. Nevertheless, they could have constituted a dangerous threat to United States victory if Japanese naval leaders had not been blind to the realities of modern war.

**Iwo Jima and Okinawa.**—Like the Japanese in April 1942, the Americans in the Pacific in October 1944 were confounded by their successes. The question was not what to do next but how to do it. In the opinion of the AAF, bombing of the home islands would bring Japan to her knees, but the Army considered that an invasion would be necessary. The Navy's main job was virtually completed. Command of the sea had been won, and sea lines of communication to the Western Pacific were secure. The submarine blockade would continue, but other naval forces would be used to support ground and air operations.

After the Marianas campaign, Spruance had recommended Okinawa as the next step. He was overruled, since MacArthur wanted to return to the Philippines and Adm. (later Admiral of the Fleet) Ernest J. King, chief of naval operations, advocated the invasion of Taiwan (Formosa). The Army, however, claimed that the latter would require 9 divisions more than would be available in the Pacific before the fall of Germany. A plan proposed by Nimitz was finally accepted: the occupation of Luzon, supported by Central Pacific forces, to be followed by the occupation of Okinawa as a base for operations against Japan. MacArthur's forces were at first scheduled to support the Okinawa campaign, but they were subsequently diverted to mopping-up operations in the southern Philippines and Borneo.

The need for the capture of Iwo Jima in the Volcano Islands between the Marianas and Japan soon became apparent. The early operations of the B-29's had been disappointing. The round trip of 2,700 miles required 16 hours; without fighter protection, bombing had to be carried out at 28,000 feet; and disabled planes with their crews were often lost on the long return flight. The only suitable island in the Volcano group was Iwo Jima. D-days were set for Luzon, Jan. 9, 1945; Iwo Jima, February 19; and Okinawa, April 1.

After losing the Marianas, the Japanese planned a new defense line that included Iwo Jima, Okinawa, Taiwan, Shanghai, and southern Korea. Ground forces in these areas were to hold out to the end without reinforcements. Suicide aircraft, named *Kamikaze* (q.v.) for the "divine wind" that had thwarted the last attempted invasion of Japan in the 13th century, would be used against the advancing enemy. The final battle would be fought in Japan itself. Bloody attrition was expected to bring the Americans to terms.

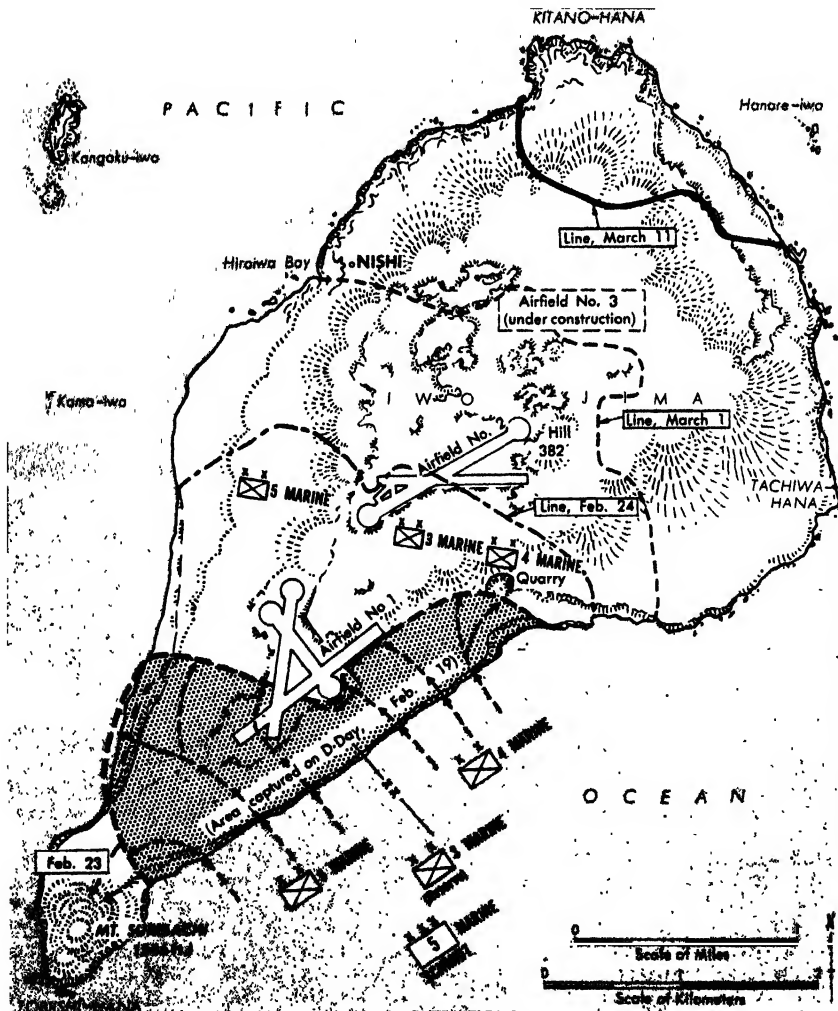
The Japanese knew that their enemy would eventually come to Iwo, and 21,000 troops were assigned to its defense. In October 1944, their commander, Gen. Tadamichi Kuribayashi, began to honeycomb the island with interconnected underground defensive positions 35 feet deep for protection against bombing and gunfire. Iwo,

shaped like a pork chop, is dominated by the 546-foot Mount Suribachi on its southwest point, while the northeastern section is a broad plateau. The airfield that the Americans wanted was in the center of the island, and the only suitable landing beaches were in the south near Suribachi. Kuribayashi therefore built his defenses on this mountain and in the north, although the entire island could be covered by artillery and mortar fire.

Operations commenced on Feb. 16, 1945, with preliminary bombardments. At 9 A.M. on February 19, assault troops of the 4th and 5th Marine divisions landed without much opposition and moved 300 yards inland. Then the guns on Mount Suribachi opened up, and the Marines suffered heavily. Nevertheless, they succeeded in crossing the southern end of the island by 6 P.M., and sufficient supplies were landed to ensure that the beachhead would be held. As enemy positions were disclosed, call-fires from the fleet were employed, and on February 24 the 3d Marine Division was landed. Mount Suribachi itself was taken on February 23, and the photograph of the raising of the American flag there became one of the best-known pictures of the war. The 3 divisions swung to the north, and the bloody work of destroying the Japanese defenders continued.

American casualties totaled almost 25,000, including 6,800 killed. Only 216 Japanese surrendered. Organized resistance ended on March 16, but a stricken B-29 had made the first emergency landing March 4. To the Marines Iwo Jima meant ugly death; to the B-29 crews, a godsend.

Okinawa, the next island on the Central Pacific's schedule of captures, is located 350 miles southwest of Kyushu, the southern main island of Japan. About 60 miles long and from 2 to 18 miles wide, it has two harbors and much flat terrain suitable for airfields. It was to be the base for the army ground and air forces that would be available, following the surrender of Germany, for the assault on Japan. Planning for Okinawa began with a study by Nimitz' staff, headed by his planner, Rear Adm. (later Vice Adm.) Forrest P. Sherman. Spruance was again to have over-all command. The ground force would be the Tenth Army under Lt. Gen. Simon B. Buckner, Jr., composed of the Army's 24th Corps of 4 divisions and the Marine 3d Amphibious Corps of 3 divisions with a division in reserve. The combat troops to be landed numbered 172,000; service troops, 115,000. Landings were to be made on the southwest coast near the airfield, which was to be seized quickly and put into operation for the land-based aircraft that would



Map 47. CAPTURE OF IWO JIMA (Feb. 19-March 16, 1945). Iwo Jima was a natural objective for the Americans. Within fighter and medium bomber range of Tokyo, it allowed fighter planes to escort and protect the B-29 bombers. It also provided a haven for B-29's in emergencies. The capture of Iwo, perhaps the most heavily fortified island attacked during the war, testified to the spirit and courage of the United States Marines. Though 6,800 Marines died on Iwo, by the end of the war emergency landings had been made on the island by 2,251 B-29's, carrying 24,761 crewmen, who otherwise might have found watery graves in the vast Pacific.

relieve the carrier forces. The Kerama-retto, a group of islands west of Okinawa, would be taken to provide anchorages for the auxiliaries servicing the naval combat forces. A British carrier task group would participate in the operation, covering the southern approaches to Okinawa.

Japanese forces on the island consisted of 77,000 well-trained army troops and 20,000 Okinawan militia and labor troops, all commanded by Lt. Gen. Mitsuru Ushijima. In accordance with the new Japanese policy, the invading force would not be resisted on the beaches but at strong positions inland, in this case in the southern part of the island. The army was to hold fast until air and naval forces, primarily suicide types, had forced the Fifth Fleet to withdraw, leaving the United States ground force unsupported. Between 2,000 and 3,000 Japanese planes would be available from 65 airfields in Taiwan and 55 airfields in Kyushu. The closest Japanese airfield was only 150 miles away.

Operations began on March 18-19 with strikes by Task Force 58 against Kyushu airfields and shipping in the Inland Sea. The results were disappointing, and 116 planes were lost and 3 carriers damaged, the *Franklin* seriously. The fight of the *Franklin's* crew to save their vessel was one of the epics of the war. More productive were the B-29 operations, striking Kyushu airfields and mining Shimoneseiki Strait between the Inland Sea and the Sea of Japan. During the last days of March, 1,300 ships converged on Okinawa. Task Force 58 began preassault strikes on March 23, and the next day old battleships moved in to commence the naval bombardment. On March 26-28, the Kerama-retto were occupied without resistance, and a nest of 350 suicide boats was discovered. Service ships and patrol planes moved in, and from March 28 to April 8 tankers fueled an average of 23 ships a day.

On April 1, 4 divisions landed on Okinawa. They encountered no opposition, and by 6 p.m. about 50,000 troops were ashore in a beachhead 8 miles long and 3 miles deep. The 6th Marine Division turned to the north, and by April 27 had secured that weakly held portion of Okinawa as well as Ie-jima, where an airstrip was made operational early in May. The 24th Corps, which had turned to the south, was stopped when it reached the first Japanese defense line on April 6. This line was not broken until April 24, and the advance bogged down again four days later. A Japanese counterattack on May 4-5 was repulsed, and Buckner then launched his principal attacks on both flanks. The Japanese line was finally broken on May 31, but organized resistance did not cease until June 21. Buckner was killed in action three days earlier.

During this long period the naval forces had to remain in the area, supporting the land operations with air strikes and gunfire and covering the reinforcing amphibious echelons. They were unable to use their great asset, mobility, and were forced to stay and absorb 1,465 aircraft attacks, most of them Kamikaze suicide raids. On April 6-7, the fleet was raided by 350 aircraft, which sank or damaged 30 ships. Similar raids continued for two and one-half months but gradually decreased in intensity, the last one of 45 planes taking place on June 22. By then, 15 naval vessels had been sunk, none larger than a destroyer, and 200 damaged.

On April 7, the Japanese Navy had its *Götterdämmerung*. The giant *Yamato*, flagship



Wide World

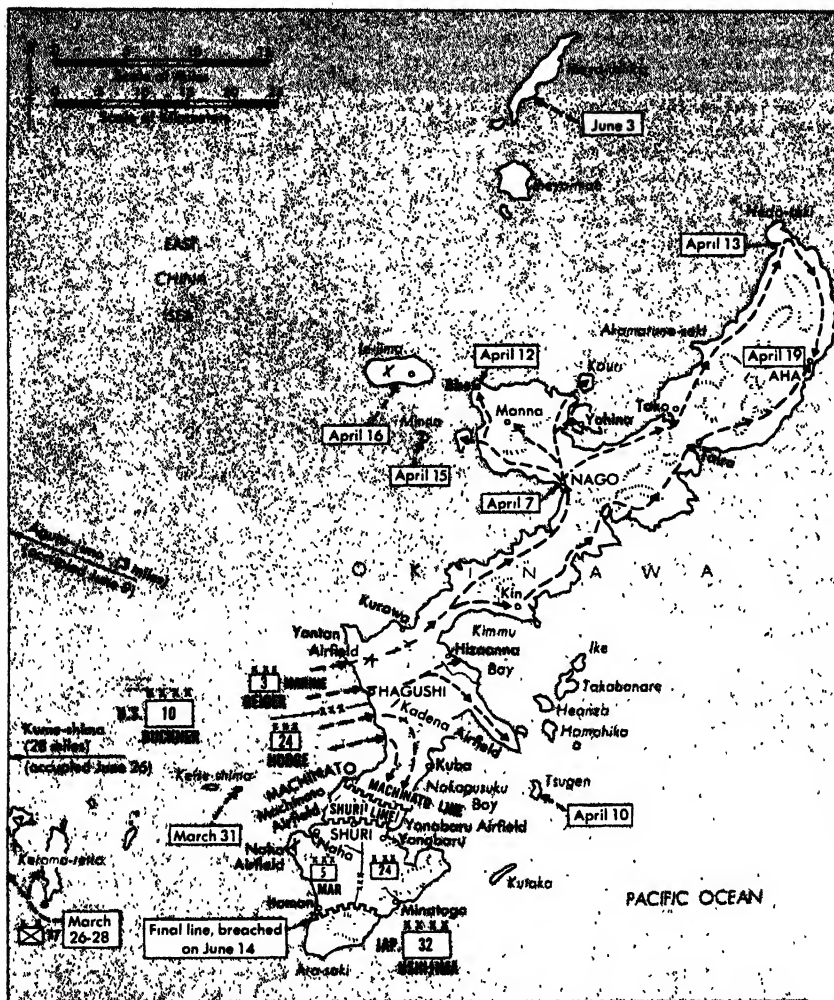
The United States flag is raised on Mount Suribachi, Iwo Jima. The hill was wrested from the Japanese by the Marines on Feb. 23, 1945, after severe fighting.

of Yamamoto at Midway, plus a cruiser and 8 destroyers with the last 2,500 tons of oil available left the Inland Sea for a suicide attack on the naval forces off Okinawa. Two United States submarines reported this force on the evening of April 6, and it was located again at 8 a.m. the next day and kept under surveillance. Beginning at noon, carrier plane attacks sank the *Yamato*, the cruiser, and 4 of the destroyers. American losses were 10 planes and 12 men. By June 10, decreased Japanese resistance ashore and the buildup of land-based air strength permitted the release of Task Force 58, which had been at sea for three months. The strain on the high command of the Fifth Fleet had become almost unendurable, and toward the end of May, Nimitz took the unprecedented step of relieving Spruance, Mitscher, and Turner by their opposite numbers of the Third Fleet before the end of the campaign.

**Bombing of Japan.**—No final plans for the defeat of Japan had been accepted by the United States Joint Chiefs of Staff (JCS) by early 1944, but it was expected that the air offensive against that country, like that against Germany, would be made in conjunction with other operations. The AAF, however, believed that in the B-29 they had a weapon capable of removing Japan from the war by mass bombing alone. This aircraft, with a range of 1,600 miles, had only been developed in 1939, but with shortcuts in testing and procurement it was coming off the production lines in such quantities as to be ready for combat early in 1944. High AAF officers were naturally anxious to get it into active operations as soon as possible.

It was anticipated that the Marianas, lying 1,350 miles south of Honshu, would provide ideal bases for B-29 operations, but these islands were not scheduled for capture until June, and several more months would be needed to construct airfields. China was the only area then in Allied





Map 48. SEIZURE OF OKINAWA (April 1-June 21, 1945). The seizure of Okinawa was essential to eliminate Japanese bases in the Ryukyu Islands and to provide air bases and support of American operations against Japan proper. As at Iwo Jima and Tarawa, it was necessary to reduce methodically the strong Japanese defenses at the cost of heavy casualties. It took from April 6 to April 24 for the Tenth Army to break the Machinato Line, and from April 28 to May 31 to pierce the Shuri Line.

hands from which attacks could be made on the main islands of Japan with the B-29. The planes would have to be based in India, and gasoline and bombs ferried into China by air for staging from fields there. Despite such logistic drawbacks, it was decided to proceed with this plan.

The long-range B-29 presented a command problem. The AAF was always reluctant to place strategic bombers outside of its own chain of command, fearing that the effects of concentration in mass bombing would be lost if used to support other types of operations. It also considered that the range of the B-29 transcended theater boundaries. Command difficulties were already evident in the China-Burma-India theater, and similar trouble might develop in the Pacific as the two advances in that area converged on Japan. AAF historians credit Admiral King with proposing the command arrangement that was finally approved. The Twentieth Air Force, the B-29 over-all command, would remain directly under JCS with the AAF member, Gen. (later General of the Air Force) Henry H. Arnold, acting as its executive agent. Theater commanders were authorized to use B-29's in their areas in the event of a strategic emergency, and they could request assistance by them at other times.

The China B-29 operation began in June 1944 with a single wing assigned to the 20th Bomber Command. The logistic burden proved immense, and little was achieved in proportion to the effort expended. Combat aircraft were forced to transport most of their own gasoline and bombs for staging; sorties averaged only two monthly, and no more than 800 tons of bombs were dropped on Japan, although some damage was done to steel plants in Manchuria. The effort was abandoned in March 1945.

Following the capture of the Marianas, a gigantic B-29 base program was initiated. Credit for the speed with which it progressed is due Lt. Gen. Millard F. Harmon, commander of the AAF in the Pacific, who had to compete for priorities in a Navy theater. Naval construction battalions and Army aviation engineer battalions built three airfields on Guam, two on Tinian, and one on Saipan. The general depot was on Guam. The 21st Bomber Command in the Marianas was placed under the command of Brig. Gen. Hayward S. Hansell, Jr. Its first wing arrived in October 1944. The initial mass attack of 111 aircraft was made on Japan on November 24. Only 88 aircraft reached the bombing point, and these dropped their bombs at a high altitude through bad weather. The results in subsequent

raids continued to be disappointing, with high operational losses, especially on the long over-water return flight. In January 1945, Hansell, who continued to maintain his faith in high-level precision bombing, was relieved by Maj. Gen. (later Gen.) Curtis E. LeMay, an experimenter and a driving executive.

The capture of Iwo Jima eased the B-29 problem. Accompanying fighters and air-sea rescue units could be based on the island, and emergency landings could be made halfway home. Approximately 2,400 such landings were made in the subsequent months of the war. The number of men saved could not be determined, but the AAF accepted King's estimate that it exceeded the number lost (6,800) in the capture of the island.

Incendiary bombing had proved effective in Germany and many AAF officers believed that it would be even more effective against Japanese cities, where wood construction predominated and housing areas surrounded industrial plants. LeMay, who had already made the decision to bomb at low altitudes, now decided to undertake

a major fire effort. The first night incendiary raid against Tokyo on March 9 burned out 15.8 square miles of the city, killed 83,000 persons, and injured 40,000. Within the next 10 days four of Japan's other large cities received similar treatment. These raids finally brought home to the people of Japan what the war really meant.

During March and April, B-29's supported the Okinawa operation by raids on Kyushu and by aerial mining of Shimonoseki Strait. This last operation, made at the request of the Navy, which had no planes suitable for the work, proved so successful that it was extended to ports on the Inland Sea and virtually ended traffic in that important body of water. By the end of July, B-29 aircraft were raiding in numbers of over 500. A total of 64 cities had been bombed, while losses in aircraft dropped to a negligible figure. Attacks became so bold that leaflets were dropped warning cities of their impending doom. LeMay kept driving his men at an exhausting pace, hoping to force a surrender before the invasion.

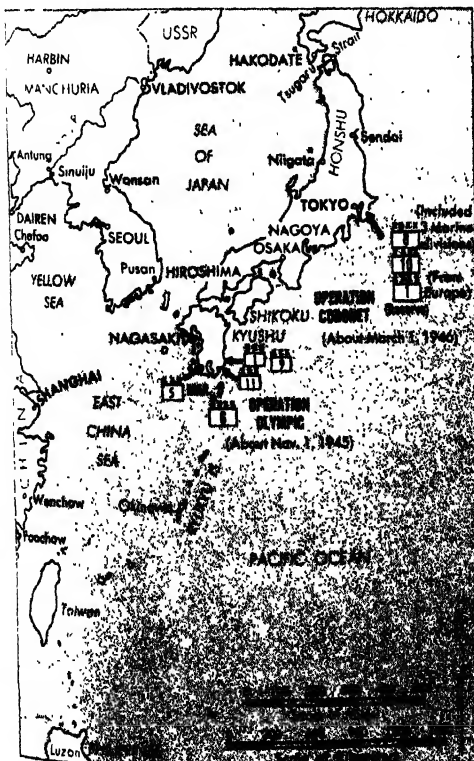
**Atomic Bombing and Surrender.**—Meanwhile, preparations were being made for the invasion of the Japanese home islands, with landings scheduled for Kyushu in November 1945. This assault, code named Olympic, was to be made with Army and Marine units then in the Pacific. Landings on Honshu, code named Coronet, were to be made in March 1946 aided by forces deployed from Europe.

By this time a search for peace was under way in Japan. Interrogations made after the war indicated that many Japanese leaders and intellectuals were convinced after the fall of Saipan that their country could not win, and the B-29 bombings stimulated efforts to bring about a surrender. In July 1944, the militaristic cabinet of Premier Hideki Tojo fell. Its successor, committed to continue the war, also fell after Okinawa was invaded. The new cabinet was directed by Emperor Hirohito to seek appropriate means to end hostilities even on terms unfavorable to Japan. Army members of this cabinet, however, were still reluctant, since the Americans had not as yet met the full force of the Japanese Army and 8,000 aircraft had been hoarded to repel the invasion effort.

The Soviet Union ominously announced to Japan in April 1944 that the neutrality pact between the two countries would not be renewed. Peace overtures were made through the USSR, but the Russians stalled. At the Potsdam Conference (July 17–Aug. 2, 1945), Joseph Stalin did not mention these overtures to President Harry S. Truman, who already knew of them through intelligence sources. In the Potsdam Declaration of July 26, the Allied leaders did announce that for Japan "unconditional surrender" would apply to the armed forces alone. This condition for negotiations was not acceptable to the Japanese cabinet, because it made no mention of the future status of the emperor. Such was the situation on August 6, when an atomic bomb was dropped over Hiroshima.

Six years before, President Franklin D. Roosevelt had received a letter from Dr. Albert Einstein, in which the eminent scientist referred to the possibility of a uranium bomb of tremendous power. This initiated a large but secret project known as the Manhattan Engineer District, under Maj. Gen. (later Lt. Gen.) Leslie R. Groves, for the development and construction of such

**Map 49. PLAN FOR THE INVASION OF JAPAN PROPER** (November 1945–April 1946). Even as the United States Tenth Army assaulted Okinawa, the Sixth and Eighth armies in the Philippines prepared for the invasion of Japan proper. Operation Olympic, the capture of Kyushu to provide air bases to support the assault on Honshu, was to be undertaken by the Sixth Army about Nov. 1, 1945. Operation Coronet, the final attack on Japan, was to be a massive affair involving the Eighth Army from the Philippines, the Tenth Army from Okinawa, and the First Army, deployed after the collapse of Germany to initial bases in the Philippines. Supporting echelons were to be moved from all major bases in the Pacific and from as far east as the west coast of the United States. Fortunately for both sides, the surrender of Japan on Aug. 14, 1945, made these operations unnecessary.



bombs. The first was exploded successfully at Alamogordo, N.Mex., on July 16, 1945. This information was sent to President Truman, who gave the authority to drop an atomic bomb on Japan after August 3. The fissionable material available was shipped to Saipan aboard the cruiser *Indianapolis* and by air. A squadron of B-29's organized for the purpose was already on the island, and one of its planes, piloted by Col. Paul W. Tibbets, Jr., was assigned to make the first drop. Capt. (later Rear Adm.) William S. Parsons, the weapon commander, made the final adjustments in flight. The bomb was dropped over Hiroshima at 8:15 A.M. on August 6, and exploded at about 2,000 feet, destroying 4.7 square miles of the city. More than 71,000 persons were dead or missing.

The Russians declared war on Japan on August 8 (effective August 9) and were soon invading Manchuria, Korea, and southern Sakhalin. On August 9, the second bomb was dropped on Nagasaki. The emperor then advised acceptance of the Potsdam terms, to which the cabinet agreed provided the imperial system be retained. United States Secretary of State James F. Byrnes drafted a reply to the effect that the emperor must be subordinate to the supreme commander for the Allied powers (SCAP), his final status to be determined by free elections of the Japanese people. On August 14, on the emperor's advice, these terms were accepted, and hostilities ceased.

The surrender took people in the Pacific generally by surprise. Moreover, after the stubborn character of Japanese resistance experienced during the war and the nature of the Japanese government, it could hardly be assumed that the military would quietly acquiesce to a surrender decision made by political leaders. Occupation forces therefore had to be ready to meet resistance. General MacArthur was made supreme commander for the Allied powers on August 14,

and plans were immediately shifted from Olympic to the occupation of the Japanese home islands by the Sixth Army from the Southwest Pacific and of Korea below the 38th parallel by the 24th Corps from the Central Pacific. The Russians were to occupy Korea above that line. The landing date had to be postponed from August 28 to August 30 because of a typhoon. The first landings were made simultaneously by the 11th Airborne Division at Atsugi Airfield near Tokyo and by the 4th Regiment of the 6th Marine Division at Yokosuka Naval Base. Formal surrender took place on September 2 aboard the battleship *Missouri* in Tokyo Bay. The surrender was followed by Operation Magic Carpet, a rapid return of military personnel to the United States for demobilization. The greatest military machine that the world had known was allowed to pass out of existence before the fruits of victory had been secured.

Meanwhile, 2 Marine divisions were sent into Japanese-held northern China until the Nationalist forces of Generalissimo Chiang Kai-shek could occupy that area. A major error, as it later proved, was made in returning to Japan the disarmed Kwantung Army and the Japanese civil administrators. This and too early withdrawal of American forces helped to create a vacuum that the Chinese Communists were to fill.

Victory in the Pacific was not just the result of interservice cooperation; it was the summation of three arms and three strategic doctrines employed to their highest capabilities. Without the seizure of bases by ground forces, there would have been no command of the sea. And without command of the sea, the B-29's would not have had the opportunity to bring Japan to her knees before the invasion of her soil. The realization of these three military capabilities was made possible by the rich resources and intelligent labor force that gave the United States an almost un-



The devastated city of Hiroshima is shown after an atomic bomb was dropped over it on Aug. 6, 1945. Only a few ruined buildings are left standing.

Wide World

On Sept. 2, 1945, as General of the Army Douglas MacArthur and Lt. Gen. Richard K. Sutherland watch, Mamoru Shigemitsu, foreign minister of Japan, signs the surrender document on board the battleship Missouri in Tokyo Bay

Wide World



limited economic potential for war. A heartland facing on two oceans, the American nation could with one hand fight a continental war in Europe and with the other a maritime war in the Pacific. In the latter its industrial power permitted two advances through areas in which the strategies of its land and sea forces could best be exploited. These advances supported each other and kept the enemy off balance. The Americans were able to profit by their mistakes, exploit opportunities, and, when necessary, see the big picture. The Japanese could not, and therein lay the margin of victory.

See also sections 12. *Developments in Naval Warfare*, 13. *Developments in Air Warfare*, and 14 *Diplomatic History*; separate biographies of the leading military and political figures; articles on areas in which the leading engagements were fought: JAPAN—22. *Foreign Relations: 1931–1945* (World War II); SUBMARINE—5. *History of Submarine Warfare* (World War II).

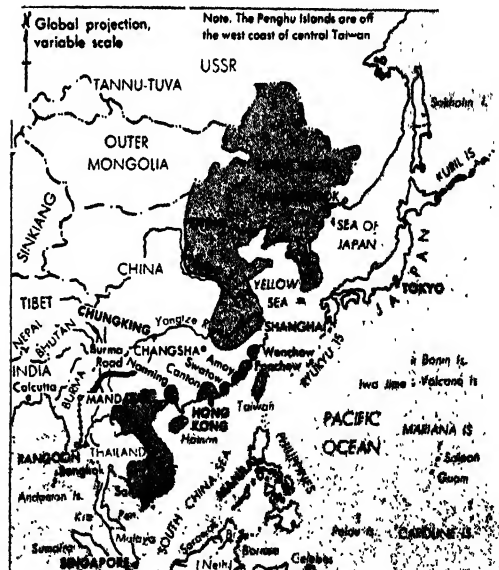
JOHN D. HAYES,  
Rear Admiral, United States Navy (Retired).

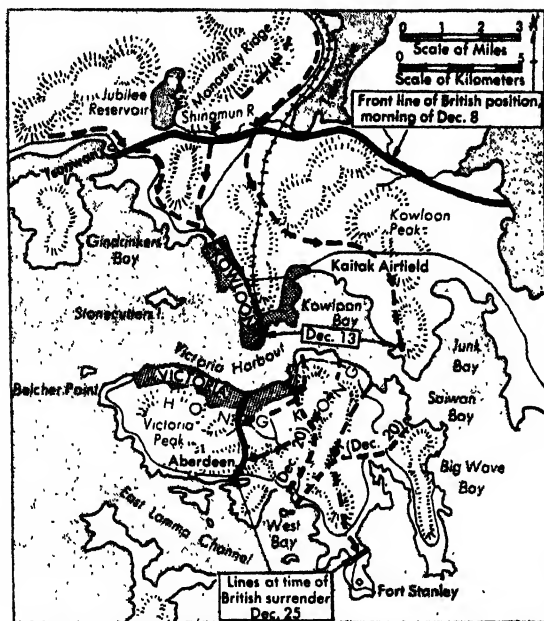
## 11. War in Eastern Asia

When Japan went to war with the United States, Great Britain, and the Netherlands in December 1941, she was already well established on the Asian mainland from Manchuria in the north to Indochina in the south. Since she possessed sovereignty over Taiwan (Formosa) and the Penghu Islands (Pescadores), she was poised to strike quickly toward the so-called Southern Regions, which included the Philippines, Borneo, Celebes, Java, Sumatra, Malaya, Thailand (Siam), and Burma, an area rich in such raw materials as oil, rubber, tin, and many other products of which she was desperately short. Of the 51 infantry divisions which composed the Japanese Army in 1941, 43 were committed to the Asian mainland: 13 to Manchuria, 2 to Korea, 25 to China, 2 to Indochina, and 1 to the island of Hainan. In addition, 2 of her 5 air divisions were also committed to Asia. She had therefore only a comparatively small force available to undertake the capture of the Southern Regions. The attacks on the Philippines and the

Netherlands East Indies are discussed in section 9. *War in the Southern and Southwestern Pacific*, and this section therefore deals only with operations on the Asian mainland: Thailand, Malaya, Burma, China proper, and Manchuria. A division from China was given the task of seizing Hong Kong; the Twenty-fifth Army, consisting of 4 divisions (of which only 3 were used) and an air division, was allotted to neutralize Thailand,

Map 50. JAPANESE PREWAR CONQUESTS IN ASIA. Japan's drive for empire began many years before World War II. She seized Taiwan from China in 1895 and annexed Korea in 1910. In 1931, on a minor pretext, the Japanese overran Manchuria. Ever-increasing demands on China brought on the Sino-Japanese War in 1937. The Japanese made substantial incursions into China proper and took control of the major Chinese ports. After the fall of France in 1940, the Vichy government was coerced into granting rights of transit in Indochina to Japanese troops, which eventually led to the occupation of all of Indochina. On Dec. 8, 1941, the Japanese controlled the areas shown.





**Map 51. CAPTURE OF HONG KONG (Dec. 8-25, 1941).** The first target of the Japanese was the British crown colony of Hong Kong. The British defense line, held by a few battalions, was quickly breached, and by December 13 the defenders had been driven from the mainland onto the island of Hong Kong. The Japanese crossed to the island in great strength and attacked persistently. Isolated and short of supplies and food, the British garrison surrendered on Christmas Day.

invade Malaya, and capture the British naval base at Singapore; and the Fifteenth Army, consisting of 2 divisions and an air division, was assigned the job of occupying southern Burma.

**Japanese Advance in Southeast Asia: 1941-1942.**—The invasion of Hong Kong began early on Dec. 8, 1941 (local time). The small garrison of this isolated outpost, consisting of two British, two Canadian, and two Indian battalions, attempted to defend the New (Leased) Territories on the mainland, but by December 13 had to withdraw to Hong Kong Island. The Japanese landed on its northern shores on the night of December 18-19 and gradually forced the garrison into the western part of the highly populated island. With no hope of reinforcement or relief and having suffered severe losses, the garrison surrendered on December 25. This freed the Japanese division to join the Sixteenth Army for the invasion of the Dutch territories farther south.

In the early hours of December 8 (local time), the Twenty-Fifth Army occupied Bangkok, thereby gaining control of Thailand, and landed a division at Songkhla (Singora) on the Kra Peninsula and part of another at Kota Bharu in northeastern Malaya. The Japanese quickly gained air supremacy, since their aircraft were far superior to and outnumbered the obsolescent Royal Air Force (RAF) planes. Two days later, Japanese torpedo bombers sank off the east coast of Malaya the *Repulse* and the *Prince of Wales*, the only two British capital ships in Eastern waters. This success ensured the Japanese complete control of the South China Sea. The British garrison of Malaya consisted of the Indian 3d Corps (two newly raised and semitrained divi-

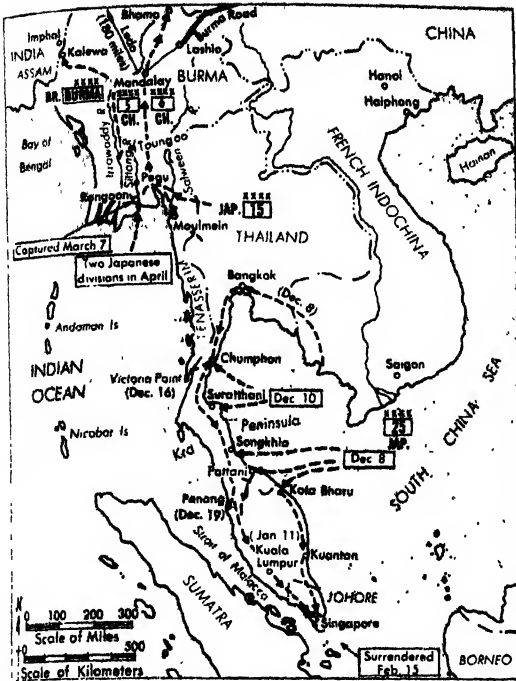
sions), which held northern Malaya, and an understrength Australian division, which held northern Johore. Constantly outflanked by infiltration through jungle-covered country and by landings on the coast behind it, the 3d Corps proved to be no match for the highly trained and experienced Japanese divisions and was forced to withdraw southward. The Japanese occupied Penang on December 19, and Kuala Lumpur on Jan. 11, 1942. Despite a stand in northern Johore by the Australians, they had driven the mauled and dispirited defenders back into Singapore Island by January 31. Although the garrison had been reinforced by two hastily dispatched and almost untrained Indian brigades and, at the last moment, by a British division diverted while at sea on its way to Egypt, the defense of the island, by then isolated by sea and air, was a hopeless task. The Japanese landed three divisions on February 8-9, and by February 13 had forced the remnants of the garrison back into a tight perimeter ringed around Singapore itself. With the city and its large Chinese and Malayan population under heavy artillery fire, water supplies cut off, and the troops short of ammunition, the garrison surrendered on February 15. In conquering Malaya, the Japanese had gained an entrance into the Bay of Bengal and the use of the Singapore naval base.

The invasion of Burma began on Dec. 16, 1941, when a small Japanese detachment occupied unopposed Victoria Point at its southern extremity; in mid-January other detachments occupied points on the Tenasserim coast. The small Burma Army was reinforced during January with what India could spare, but when the main invasion began it consisted of only two ill-equipped divisions, composed of British, Indian and Burmese troops, supported by a very small air force, which included a squadron from Bug Gen. (later Maj. Gen.) Claire L. Chennault's American Volunteer Group (Flying Tigers) in China. On January 20, two Japanese divisions crossed the Thai frontier east of Moulmein. Outflanking and outmaneuvering the Indian division facing them, they captured Moulmein on January 31, and by February 24 had forced the defenders back across the Sittang River.

In December 1941, Generalissimo Chiang Kai-shek, anxious lest the Burma Road, along which lend-lease supplies were reaching China from Rangoon, should be cut, had offered Chinese troops to assist in the defense of Burma. Their entry into Burma from the north in mid-February enabled the other division of the Burma Army (now reinforced by an armored brigade and other troops) to move south to help in the defense of Rangoon. The advance of the Japanese was, however, too rapid: they drove a wedge between the two divisions before a junction could be made, and on March 5 captured Pegu. Rangoon could no longer be held and, after some hesitation, was evacuated on March 7. Its garrison, escaping somewhat luckily from the encircling Japanese forces, withdrew up the Irrawaddy toward Prome.

The defense of central and northern Burma now rested on the Burma Army (two weak divisions) in the Irrawaddy Valley, and on the Chinese Fifth and Sixth armies (equivalent in strength to two American divisions) in the Sittang Valley on the direct railway from Rangoon to Mandalay. The Chinese were under the command of Lt. Gen. (later Gen.) Joseph W. Stil-





Map 52. FALL OF BURMA AND MALAYA (Dec. 8, 1941–May 20, 1942). The Japanese invaded Burma and Malaya in great strength, as shown. The limited British and Chinese forces available fought to stem the Japanese advances, but they were forced back by overwhelming power. On Feb. 15, 1942, Singapore, bastion of British strength in the Far East, fell. By late May, the Allied forces had been driven from Burma into India and China.

well, who had also been appointed commanding general of the American China-Burma-India (CBI) theater in February 1942. The possession of Rangoon and the cessation of hostilities in Malaya enabled the Japanese to reinforce the Fifteenth Army in Burma with two fresh divisions, two tank regiments, considerable artillery, and a number of air regiments. They quickly advanced toward Mandalay in an attempt to destroy the defenders in the loop of the Irrawaddy River. Having captured Toungoo on March 30, they drove rapidly north, passing round the Chinese left flank, and by the end of April had cut the Burma Road at Lashio. The Burma Army had no alternative but to withdraw across the Irrawaddy. Burma could now no longer be held. The Burma Army and two Chinese divisions withdrew into Assam, the former by way of Kalewa to Imphal and the latter from Myitkyina to Ledo. The rest of the Chinese armies withdrew eastward across the Salween River into China. By the end of May 1942, the Japanese were in control of the whole of Burma and had occupied the Andaman and Nicobar Islands. They had thus attained in five months all their objectives and secured the western end of their long defensive perimeter around the Southern Regions.

With the control of the Strait of Malacca and the Bay of Bengal in their hands, the Japanese sent part of their naval forces, including aircraft carriers, into the Indian Ocean for a short time early in April to bomb Colombo and the naval base at Trincomalee in Ceylon and to raid the

shipping routes along the east coast of India. Neither the British nor the Japanese were seeking a fleet action but, before the enemy force withdrew to Singapore, its aircraft had sunk two British cruisers, a small aircraft carrier, two destroyers, and a corvette and had accounted for approximately 100,000 tons of merchant shipping.

The loss of Burma and of the command of the sea and air in the Bay of Bengal left India wide open to invasion by land or sea. Since the best Indian formations had been sent to Iraq and Egypt and the equivalent of three divisions had been lost in Malaya and Burma, there was little with which to undertake her defense until her many newly raised divisions were trained, equipped, and ready for battle. Strenuous efforts were therefore made to build up forces for her defense and that of Ceylon. Three British divisions were diverted from the Middle East theater, and an African division was sent from East Africa. A beginning was also made in the buildup of a large Allied strategic and tactical air force, including the United States Tenth Air Force, and the India-Burma Division of the United States Air Transport Command to ferry supplies from Assam across the "hump" to China, which was now cut off from all land access from the west. This entailed an enormous program of airfield construction in Bengal, Assam, and elsewhere in India, which stretched Indian engineering resources to their limit. Faced with the defense of her eastern frontier (an eventuality which had never been envisaged), India had also to reorientate her logistical organization and improve the very poor rail and river communications from Calcutta to eastern Bengal and Assam. In her efforts to do this she was hampered by having sent much of her river and coastal shipping and a large proportion of her meter-gauge railway locomotives and rolling stock to Iraq to help in its defense. The buildup therefore could only be accomplished over a longish period of time.

With the American naval victories of the Coral Sea in May and Midway in June 1942, the danger to India passed, and the main problem now facing the Allies was how to keep China in the war. To reach Kunming by road from Assam necessitated the reoccupation of northern and central Burma and the building of a road from Ledo through Myitkyina and Bhamo to join the original Burma Road. Since to accomplish this would take considerable time, it was decided to increase deliveries of supplies by the air ferry route to a tonnage sufficient to supply the needs of Chennault's Fourteenth Air Force and reequip approximately 30 Chinese divisions. The Chinese troops who had reached India in 1942, gradually reinforced by men flown from China, were reformed, equipped, and trained by Stilwell, who aimed at producing three elite Chinese divisions (each of 10,000 men) with tank and artillery support.

**Operations in Burma: 1942–1943.**—Gen. (later Field Marshal) Sir Archibald Wavell (later 1st Earl Wavell), the commander in chief in India, made every effort to take the offensive to recapture Burma as soon as practicable, but the means were not to hand until time allowed his land and air forces to be assembled and trained and his communications to the eastern frontier built up. Nevertheless, he launched an offensive in October 1942 by one division to

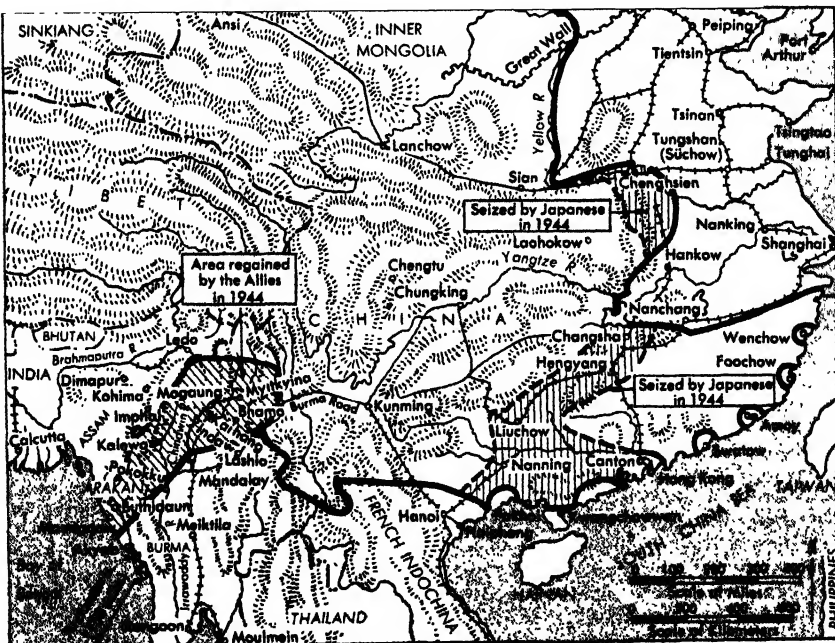
capture Akyab in coordination with an amphibious assault on the port. Maungdaw and Buthidaung were occupied on December 17, but the formation earmarked for the amphibious assault and its landing craft were delayed by extended operations to wrest Madagascar from the control of supporters of the Vichy French government. Wavell therefore decided to continue with the land advance and, when within striking distance of Akyab, to launch a short-range amphibious attack. The Japanese had meanwhile brought their forces in Arakan up to divisional strength, and early in March 1943 halted the land advance too far to the north of the port to make a short-range amphibious operation possible. They then launched a counteroffensive and by the break of the monsoon in May had recaptured Buthidaung and Maungdaw. Although Wavell's effort had failed, it brought to light defects in the organization and training of the rapidly expanding Indian Army. These were eliminated, and by the end of 1943 the British-Indian divisions had reached a pitch of training which made them equal to the Japanese.

In July 1942, Wavell formed a long-range penetration brigade (Chindits) under the command of Brig. (later Maj. Gen.) Orde C. Wingate. On Feb. 14, 1943, the Chindits, some 3,000 strong, crossed the Chindwin River and, supplied by air, penetrated deep into Burma without meeting much opposition and damaged the railway south of Indaw. Wingate then crossed the Irrawaddy into a somewhat waterless area, but its many roads and tracks enabled the Japanese to surround his force, which had to disperse and get back as best it could. By early June, only 2,200 men had got out of Burma to Assam or China. This incursion had little strategic value in itself, but it gave a considerable moral fillip to Britain and India and showed clearly that troops in jungle country could be supplied by air. Its greatest effect, however, was that it made the Japanese decide to improve their defensive positions in Burma by taking the offensive toward

Assam, a decision which was to prove fatal.

**Campaigns in Burma and China: 1943-1944.**—In November 1943, the Anglo-American South-east Asia Command (SEAC) was formed with Adm. Lord Louis Mountbatten (later 1st Earl Mountbatten of Burma) as supreme commander, and General Stilwell as his deputy, with the object of controlling all operations in Southeast Asia. In December, the United States Tenth Air Force and the RAF wings in India were combined into the Eastern Air Command under Maj. Gen. (later Lt. Gen.) George E. Stratemeyer. Meanwhile, plans were made to establish the 20th Bomber Command, equipped with long-range B-29 aircraft, at Chengtu in Szechwan Province, China, from where Manchuria and the Japanese mainland could be bombed.

The plans for the 1944 campaign prepared by the supreme commander included a combined thrust by Stilwell's Chinese forces from Leds toward Myitkyina, by British-Indian forces across the Chindwin toward Indaw, and by the Chinese Yunnan armies across the Salween with the object of reoccupying northern Burma and opening a land route to China. A subsidiary attack was to be made in Arakan to capture Akyab and if resources allowed, the Andaman Islands. Resources, however, did not permit an amphibious operation to be mounted in the Indian Ocean, and Chiang Kai-shek refused to commit his Yunnan armies across the Salween. The plans for 1944 had therefore to be reduced to a land advance toward Akyab, a drive down the Hukawng Valley toward Myitkyina, and an incursion by the Chindits (now enlarged to six brigades and known as Special Force) to the Indaw area to cut the enemy communications to the north and so assist Stilwell's thrust on Myitkyina. The Japanese, on the other hand, having decided to take the offensive, planned to advance in March 1944 across the Chindwin to capture the British base at Imphal, and to attack in Arakan in February to forestall the expected Allied advance in that area.



**Map 53. OPERATIONS IN BURMA AND CHINA DURING 1944.** It was not until the beginning of 1944 that the Allies could accumulate sufficient resources to launch a real offensive in Burma. Progress was slow against the Japanese resistance and counterattacks, but by the end of the year the area shown had been regained, and land communications had been reopened with China via the Leds Road (eastern portion of the Burma Road). Meanwhile, stung by B-29 air attacks from bases in southern China, the Japanese advanced as shown and captured the airfields. In 1944 also, they advanced their lines in the area of Chengchow (now Chengchou).

At the end of the monsoon the Indian 15th Corps of the Fourteenth Army under the command of Lt. Gen. (later Field Marshal) Sir William Slim (later 1st Viscount Slim) was gradually approaching the strong defensive positions in Arakan covering Maungdaw and Buthidaung when, on February 4, the Japanese launched their offensive. They passed approximately 5,000 men behind the forward Indian divisions, thus cutting their communications. Supplied by air, these stood firm, and reserves brought forward threw back the Japanese with heavy loss. The British offensive was then resumed, and by the break of the monsoon in May the Japanese had been driven out of all their main defenses covering Akyab.

The Japanese offensive toward Imphal was launched by the Fifteenth Army in mid-March, but, on the assumption that Imphal would be captured in three weeks, inadequate logistical plans for its maintenance had been made, a mistake which was to prove disastrous. In accordance with the Fourteenth Army's prearranged plan, the Indian 4th Corps withdrew to prepared positions covering the Imphal plain as soon as the enemy crossed the Chindwin. The corps was isolated from India when the Imphal road was cut on March 29. Kohima was attacked on April 4 and surrounded by April 8. A division was flown into Imphal from Arakan, and the Indian 33d Corps was brought forward from India and concentrated at Dimapur. The Allies had by now gained air supremacy over Burma, and, supplied by an airlift, the 4th Corps was able to hold its position around Imphal and in May to begin a counteroffensive, while the 33d Corps, after relieving the Kohima garrison, took the offensive southward. By the end of June, the two corps had met, and the Imphal road was reopened. The defeated Japanese Fifteenth Army, short of food and ammunition, retreated to the Chindwin in considerable disorder.

Stilwell had begun his advance from Ledo toward Myitkyina in January. On orders from Chiang, the Chinese divisions did not press forward as fast as they might, but progress was made thanks to Merrill's Marauders (the 5307th Composite Unit led by Maj. Gen. Frank D. Merrill and the American counterpart of the Chindits), and by the end of March the Hukawng Valley had been cleared and entry into the Mogaung Valley secured. On April 28, the Marauders, reinforced by some Chinese regiments, began to move east across the mountains and then south to capture Myitkyina from the north by surprise. On May 17, this force occupied the Myitkyina airfield, but its exhaustion was such that, despite reinforcements brought in by air, it was unable to drive the Japanese from the town, and a four-day struggle began that lasted 11 weeks.

To assist Stilwell's advance, three brigades of Special Force were moved into Burma by air and by march route. By the end of March 1944, approximately 12,000 men, supplied entirely by air, were established around Indaw and had formed a block north of the town on the road and railway leading to Mogaung, thus effectively cutting the communications of the enemy forces facing Stilwell. The Japanese made repeated unsuccessful attempts to break the block, but it became evident early in April not only that the block might be overwhelmed by a newly arrived Japanese division, but that Special Force could not be maintained at Indaw during the monsoon.



Wide World

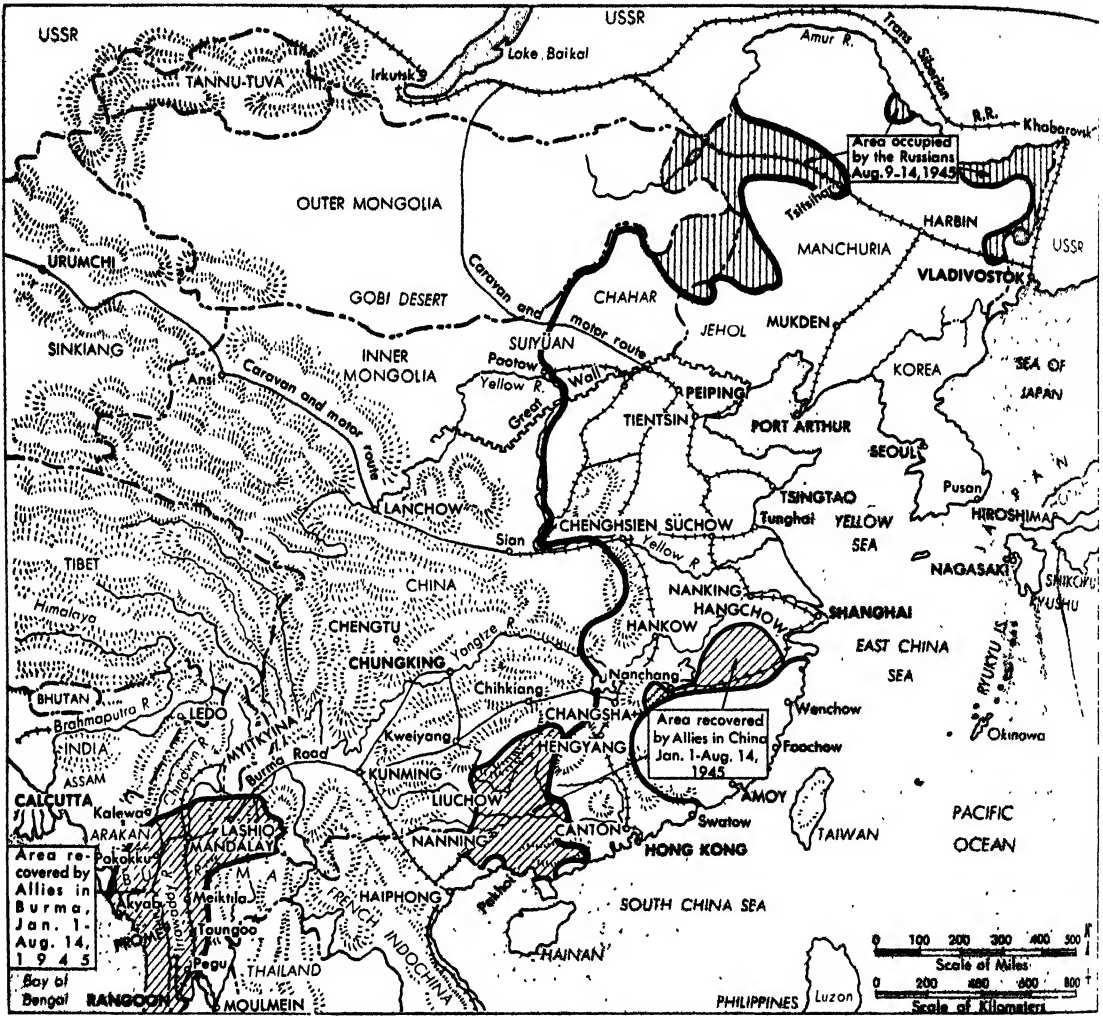
The special American unit known as Merrill's Marauders crosses a stream in northern Burma in pursuit of the retreating Japanese during the 1944 campaign.

It was therefore ordered to move north at the end of April, establish a new block nearer Mogaung, and come under Stilwell's command beginning on May 17.

By threatening to withdraw aid for the re-equipment of his armies, the Americans at last obtained Chiang's agreement to the Yunnan armies taking the offensive across the Salween on April 10. This offensive, however, failed to help Stilwell to capture Myitkyina, for an inferior Japanese force brought the Chinese to a halt by the end of June before a line of defended walled towns not more than 20 miles west of the Salween.

Special Force established its new block south of Mogaung on May 7 but was forced to abandon it with heavy loss on May 25. The Japanese were now free to reinforce Kamaing or Myitkyina but did not move quickly enough to do either. Stilwell occupied Kamaing on June 16, and a brigade of Special Force, with some assistance from a Chinese division, occupied Mogaung on June 26. Stilwell was now able to use the road to Myitkyina; his forces were reinforced and finally occupied the town on August 3. The capture of Myitkyina was of great value for, once airfields had been constructed and a pipeline built from Ledo to them, the air ferry could operate into China without flying across the "hump."

There was little more than sporadic fighting in China during 1942 and 1943. By the beginning of 1944, Chennault had established a base for the B-29's at Chengtu and a chain of airfields in eastern China astride the Hankow-Canton railway, from which the Fourteenth Air Force could support the Chinese armies. Since these latter airfields constituted a danger, the Japanese decided to eliminate them. In April and May, they cleared the Peiping (Peking)-Hankow railway, and at the end of May began to advance southward. Despite the support of the Fourteenth Air Force and at times of the B-29's, the Chinese armies were no match for the Japanese. By mid-December, assisted by an ad-



Map 54. OPERATIONS IN BURMA AND CHINA DURING 1945. The shaded areas in Burma and southern China indicate the territory recaptured from the Japanese by the Allies from Jan. 1, 1945, to the capitulation of Japan on Aug. 14, 1945. The shaded areas in Manchuria indicate the territory occupied there by the Russians from their entry into the war on August 9 to its end on August 14. The Russians also invaded northern Korea and occupied southern Sakhalin before V-J Day, and they continued on to occupy more of Manchuria and the Kuril Islands.

vance westward from Canton, the Japanese had occupied all but two of the American airfields in eastern China, had made contact with their garrison in Indochina, and had created a threat to both Kunming and Chungking. Meanwhile, in June, the B-29's from Chengtu had begun to bomb targets in Manchuria and western Japan.

**Recovery of Burma and Final Operations Against Japan: 1944-1945.**—In October 1944, Stilwell was recalled to Washington, and the CBI theater was divided. Maj. Gen. (later Lt. Gen.) Albert C. Wedemeyer replaced Stilwell as commanding general of the China theater and Lt. Gen. Daniel I. Sultan took command of the Burma-India theater, which remained part of SEAC. Soon after taking up his command, Wedemeyer, conscious of the threat to Chungking and Kunming, advised Chiang Kai-shek to concentrate a force of 30 Chinese divisions to meet it. To provide a trained nucleus for this force, he asked for the eventual return to China of all the Chinese divisions (by now numbering

5) operating in northern Burma; 2 were sent him in January 1945.

In Burma the Fourteenth Army relentlessly pursued the defeated Japanese throughout the monsoon. Despite appalling climatic conditions, which turned roads and tracks into quagmires, Kalewa was captured and bridgeheads were established across the Chindwin at many points by the first week in December 1944. Slim was now ready to advance into central Burma. He sent his 33d Corps in a wide sweep toward the Irrawaddy with Mandalay as its objective, and with great secrecy passed the 4th Corps southward from Kalewa to Pakokku, with Meiktila on the main enemy communications between Rangoon and Mandalay as its objective. By Feb. 1, 1945, supplied almost entirely by air, the Fourteenth Army had closed up to the Irrawaddy from a point 40 miles north of Mandalay, where it had seized bridgeheads across the river, to Pakokku 140 miles farther downstream. On the Arakan coast the 15th Corps began to advance as soon

as the monsoon abated and occupied Akyab, which had been abandoned by the Japanese two days earlier, on January 3. An amphibious attack was launched on Ramree Island on January 21, and the island was finally occupied during February. Airfields were rapidly built at Akyab and on Ramree Island to make it possible for the Fourteenth Army to be supplied by air in its drive toward Rangoon from the Irrawaddy.

In northern Burma the southward advance from Myitkyina, begun by Stilwell in October 1944, made slow progress, and it was not until December 15 that Bhamo was occupied. Sultan, who now had an American brigade (which incorporated the Marauders), a British division, and three Chinese divisions, pressed on and made junction with the Yunnan armies on the old Burma Road on Jan. 20, 1945. The road from Ledo to China was now clear, and the first convoy from India passed along it to reach Kunming on February 4. Work was immediately begun on extending the Ledo-Myitkyina oil pipeline to Kunming. Meeting with little opposition, for the Japanese were forced by the threat to Mandalay to withdraw southward, Sultan's forces occupied Lashio on March 7. Meanwhile, using Myitkyina as a staging post, the Air Transport Command had doubled the monthly air deliveries to China. With this increase and a road and pipeline from India, China was no longer isolated from her allies.

The Japanese sea communications with the Southern Regions, already precarious owing to the activities of the American submarine fleet, were completely severed when Leyte and Luzon in the Philippines were reoccupied in the winter of 1944-1945. The Japanese armies in the Southern Regions, forced to exist on the countries they had occupied and such reserves of war material as they had stored, withdrew divisions from outlying territories, including Burma, to reinforce Indochina, now open to invasion from the Philippines, and thus weakened their ability to defend the other areas.

By the end of February 1945, a fleet of river craft had been assembled on the Chindwin at Kalewa to supplement air supply and, with adequate supplies ensured, Slim began to cross the Irrawaddy in mid-February. The 4th Corps captured Meiktila by surprise on March 3, and shortly thereafter Mandalay was invested from both the north and the south. In a desperate attempt to stave off final defeat, the Japanese concentrated their remaining forces in Burma and launched a counteroffensive to recapture Meiktila; fierce battle raged throughout March, but by the end of the month Mandalay had been captured, and the Japanese had been thrown back with very heavy losses, their armies losing all cohesion. This offensive proved to be their last in Burma. Slim immediately resumed the pursuit toward Rangoon along both the main railway and the Irrawaddy. Toungoo was occupied on April 2 and Prome on May 2, and Pegu was reached on April 29. To ensure that Rangoon was occupied before the monsoon broke, an amphibious landing, preceded by a parachute drop, was made near the mouth of the Rangoon River on May 2, and the city, which had been hastily evacuated by the Japanese a few days before, was entered without opposition on May 3. The campaign for the reoccupation of Burma was now over, except for extensive mopping-up operations, and SEAC began to prepare for the invasion of Malaya. With the virtual end of the Burma campaign, all

the American and Chinese resources remaining in India and Burma were gradually transferred to China, and plans were made in Chungking for an offensive by 39 divisions to capture a port in eastern China in the fall of 1945.

The swift progress of the American offensive in the Pacific (see section 10. *War in the Central and Northern Pacific*) culminated in the capture of Iwo Jima in March and of Okinawa in June 1945. The Americans now had forward bases for an invasion of Japan, and the Japanese were forced to withdraw troops from Manchuria, Korea, and China to defend their homeland. In China, to forestall any amphibious landing, they began to withdraw toward its coast and concentrated their forces in the Canton area, the lower Yangtze Valley, and Shanghai, thus enabling the Chinese, with American assistance, to reoccupy many of the airfields in eastern China which had been lost the previous year.

Japan opened negotiations for peace on August 10 after atomic bombs had been dropped on Hiroshima and Nagasaki on August 6 and August 9. On August 14, she surrendered unconditionally. The USSR declared war on Japan on August 8 (effective August 9) and, using a massive force of three strong army groups, invaded Manchuria, Korea, southern Sakhalin, and, later, the Kuril Islands. The Japanese armies in Manchuria, reduced in size and weakened by the need to provide for the defense of the homeland, could offer little resistance, and when hostilities ceased on August 14, Russian troops were close to their objective, Mukden (now Shenyang) in Manchuria, had landed a force on the northeast coast of Korea, and had occupied Sakhalin.

In China the isolated Japanese armies also surrendered, and Hong Kong was freed. In the Southern Regions troops were sent to occupy Singapore, Bangkok, and Saigon early in September, and on September 9 the amphibious attack on Malaya took place as planned but under

British troops attack the enemy in a native basha (h in a banana grove. The dense vegetation is typical of combat areas of the Burma theater of war.

Imperial War Museum, London





peacetime conditions. The Japanese armies in the Southern Regions formally surrendered at Singapore on September 12. The long task of rounding up the Japanese forces and recovering the many thousands of Allied prisoners of war throughout the area then began.

**War on the Mainland in Retrospect.**—The Japanese were able to gain all their objectives in Asia in 1941–1942, for the United States was unready for war, and Britain, fighting single-handed in Europe, could not find the means with which to defend her interests in the Far East adequately. Thereafter the course of the war on the Asian mainland fell into two phases. The first, in 1942–1943, was one of comparative inactivity while the Japanese digested their conquests and organized their defenses and the Allies gathered their strength, overcame their grave logistical difficulties, and kept China in the war by air supply. During the second phase, in 1944–1945, the Allies launched an offensive to recapture Burma and drive a road through to China. The offensive succeeded, but before further operations could be mounted to liberate Malaya and other occupied territories, the war came to a sudden end as a result of the rapid American offensive across the Pacific to the very threshold of Japan and of the dropping of atomic bombs, which forced Japan to capitulate. It was thus the surrender of her wide-flung armies in Asia which followed, rather than their defeat in the field, that eventually freed the greater part of the Asian mainland from Japanese domination.

See also section 13. *Developments in Air Warfare*; separate biographies of the leading military commanders; BURMA ROAD; CHINA—8. *History* (War with Japan); JAPAN—22. *Foreign Relations, 1931–1945*; MALAYA—8. *History*; MANCHURIA—5. *History* (Modern History, 1895–1945).

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## 12. Developments in Naval Warfare

Naval developments in World War II may be divided into four categories: (1) carrier operations, (2) amphibious operations, (3) mobile logistics, and (4) antisubmarine warfare. The development that overshadowed all others was the task force system whereby both carrier and amphibious operations were conducted in the Pacific. Also of major importance was the development of the mobile logistics that enabled the task force system to be employed. In addition, the developments that resulted from the campaign against German submarines may have been particularly significant because of their relation to future naval warfare.

**Task Force System.**—During World War II the expression "task force" used in connection with fast carrier operations in the Pacific caught the imagination of the American people and became part of their language, though with a variety of meanings. In the working language of the United States Navy, however, "task force" is one of a group of terms employed in connection with a system of organization which it has evolved for managing its combat ships in order to make the most effective use of sea and air in modern, fast-moving warfare, while at the same time providing for the maintenance, support, and constant replenishment needed by these ships. In naval warfare it is the manned ship that fights, not the man himself. A combat ship functions

only at sea, but it must return to port at various intervals to prepare and replenish itself again for sea duty. It is therefore possible to separate in time the tactical employment from the logistics of a ship, its operation from its administration, and this separation is carried over into naval organizational structure in a manner not possible in land warfare.

The task force method of conducting naval warfare is a byproduct of what might be called the task-type organization of naval operating forces. In this method of organization a combat ship's captain actually works for two commanders. He is under the operational control of a task commander, who is responsible for completing some task within the Navy's mission; and is under the administrative control of a type commander, who is responsible for the ship's upkeep, supply, discipline, and (within certain limits) training. Broadly speaking, a task commander is concerned with functions of purpose, and he serves as operational commander of a composite force of ships suited to a particular purpose. A type commander is concerned with the functions of support, and he maintains the readiness of his ships, which are usually of one type, such as carriers, cruisers, or destroyers. He is an administrative commander and does his job primarily with such of his ships as are in port.

The task force organization of combat ships was best represented during World War II by the carrier task forces, which also included battleships, cruisers, and destroyers. Amphibious task forces were composed of amphibious ships of all types, as well as battleships for gunfire support, small carriers for air support, and destroyer types for antisubmarine protection. Replenishment task forces consisted primarily of tankers, ammunition ships, and salvage tugs, with a cruiser flagship and small carriers and destroyer types for protection. These task forces could be divided into task groups and task units, while the administrative commands retained the older designations of squadron and division. The task concept was expanded to the fleet level in 1944. The two task fleets in the Central Pacific were the Fifth and Third fleets: the Fifth Fleet conducted the operations against the Marianas, Iwo Jima, and Okinawa, while the Third Fleet assisted Gen. (later General of the Army) Douglas MacArthur in the recapture of the Philippines. The units that composed these fleets came from the pool of Central Pacific ships, which were assigned or withdrawn as operations required and the condition of the individual ships warranted. When ships were withdrawn from operational status, they reverted to the control of their type commander, whose headquarters were usually located with that of the commander of the Pacific Fleet. Ships newly commissioned or reverting to operational status after extensive repairs were assigned temporarily by the type commander to training commands, which specialized in preparing ships for combat. Such training was usually conducted outside of operational areas, although Japanese forces on bypassed Pacific islands provided targets for aircraft training.

**Carrier Operations.**—The task force system was most widely exemplified in carrier operations. The destruction of the battleships at Pearl Harbor in December 1941 made the capital ship of the United States Navy the carrier, with its main battery of manned striking aircraft carrying torpedoes and bombs and a defensive system con-

sisting primarily of fighter planes. Only the Japanese and United States navies developed carrier operations to a high degree. The technique of operating aircraft from carrier decks and the tactics of various aircraft types, especially the dive bomber, had been developed before the war and were similar in both navies. Usually the Americans initiated these developments, while the Japanese copied and perfected them.

As a capital ship, the carrier caused a revolution in naval tactics. As long as the gun remained the major weapon, the standard combat formation was the battleline, with light forces disposed on the engaged van and rear. When carriers first operated with the fleet, they took station on the unengaged side. As the manned airplane with its longer range replaced the big gun, the battle formation was changed to a circular one, with the carriers in the center, and other forces disposed around them to give them protection. United States formations were generally tight, with all the ships making tactical movements together in a task group that included four carriers. The Japanese operated in looser formations, and carriers with their attached ships conducted flight operations independently.

The primary striking carrier weapons in the United States Navy were the TBF Grumman Avenger, which could be used as a torpedo plane or as a level bomber, and the SDB Douglas Dauntless, a scout and dive bomber. The fighter that finally triumphed over the Japanese Zero was the Grumman F6F Hellcat. Japanese aircraft were also given identification names by the Allied forces. The famous Mitsubishi Zero fighters, for example, were called Zekes, while the long-range, two-engine Mitsubishi bombers were known as Bettys.

All American ships were equipped with aircraft and surface radar by the end of 1942, but radar did not come into general use in the Japanese Navy until late in 1943. The Japanese fought such major actions as the battles of the Coral Sea and Midway without it. United States fighter aircraft in these and subsequent engagements were directed against oncoming raids by fighter directors using radar, thereby enabling the fighters to meet enemy aircraft from 50 to 70 miles out. The extensive use of radar resulted in the establishment in United States ships of a combat information center (CIC), where all information received was analyzed and plotted and then relayed to the flag or commanding officer for his action. In some cases the officer in tactical command took his station in the CIC. It was surface radar that finally enabled the Americans to overcome the superiority of the Japanese in night actions.

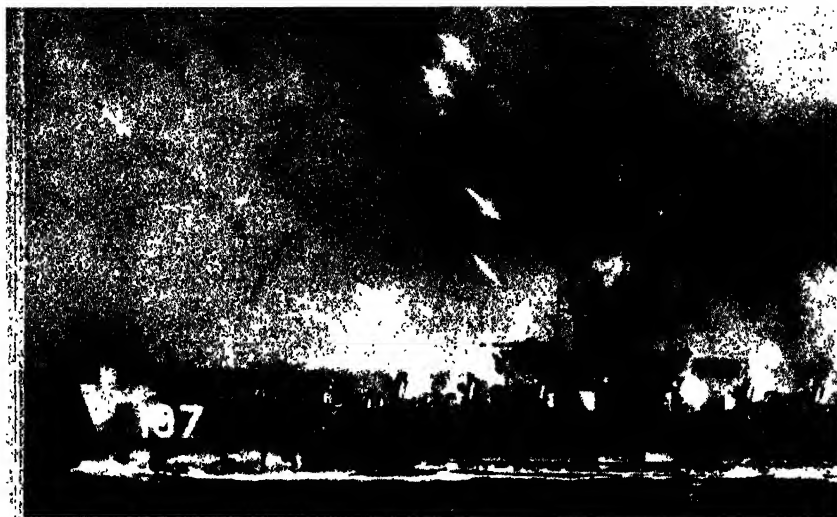
Antiaircraft fire from United States ships early in the war was not effective, and enemy planes that were able to elude the United States fighter planes had good chances of making a successful attack. The variable-time (VT) or proximity fuze in antiaircraft ammunition, which was adopted in the Pacific in January 1943, changed this situation. An influence fuze, the VT was actually a small radar set that triggered the firing mechanism within 70 feet of the target in its destructive zone. At first it was restricted to naval actions, since it was feared that its use against land targets would result in its discovery by the enemy. In 1944, VT fuzes were employed successfully against V-1 flying bombs, as well as by ground forces in the Battle of the Bulge, the importance

of which was considered to justify the possibility of discovery. Exploding a short distance above the ground, this fuze made the foxhole valueless as a safeguard for the foot soldier.

**Amphibious Forces.**—All ground operations in World War II began with amphibious assaults. The first, made in August 1942 at Guadalcanal, was a defensive operation designed to seize the island in order to halt the Japanese thrust into the Solomons. It was followed in November by landings in North Africa. Amphibious operations in Europe included the assault on Sicily in July 1943, the cross-Channel invasion of Normandy in June 1944, and the movement into southern France in August. These were all primarily operations intended to seize beachheads from which large forces would subsequently break out for land campaigns. In the Pacific, however, one amphibious operation necessarily followed another. Amphibious operations in the Southwest Pacific were made at frequent intervals in relatively short shore-to-shore movements, while in the Central Pacific they involved large lifts over long distances. The assaulting forces in Europe were Army troops, whereas in the Central and Southwest Pacific both Marine and Army forces were employed. A greater amount of improvisation was necessary in the Southwest Pacific than in the Central Pacific, since naval elements were smaller and the theater generally received lower priorities for amphibious equipment.

Because of sound doctrine and proper landing equipment, all United States amphibious operations in World War II were successful. The doctrine had been developed by the United States Marine Corps in the two decades before the war, under the shadow of the British failure at Gallipoli in World War I. It was set forth in a *Manual for Landing Operations*, which attempted to define (1) command relationships; (2) naval gunfire support; (3) air support; (4) ship-to-shore movement; (5) the securing of the beachhead; and (6) logistics. The basic doctrine outlined in this manual withstood the long trial by fire in war without fundamental changes.

The reason for this success was without doubt the provision of adequate craft for the landing of assault units and for logistic support over the beaches until proper port facilities could be built. The landing craft were of two basic types: (1) ships and boats that had the ability to beach without swamping, and also to withdraw; and (2) amphibians. Hulls of the first type were designed so that the craft grounded on only a small area forward. In withdrawing, the slipstream from the protected propeller washed away sand in the grounded area, thus releasing the craft from the beach. A ramp forward facilitated the rapid discharge of passengers and cargo. The smaller types, which were carried aboard transports, were designed by Andrew J. Higgins, a New Orleans boatbuilder. These were the LCPV (landing craft, vehicle and personnel) and the LCM (landing craft, medium), which were capable of transporting a tank. A larger type, designed to proceed under its own power to the designated area, was of British design; it included the LST (landing ship, tank) and the LCI (landing craft, infantry). The LCI subsequently evolved into a close-support gunboat type, while the LST with its ample tank deck became one of the most useful crafts in the war, employed in a range of logistic services far beyond those originally intended. LST's were employed as hospital



A rocket ship (LCI) attacks Okinawa before the invasion of the island by the United States Tenth Army on April 1, 1945

Wide World

ships, barrack ships, tenders for small landing craft, floating machine shops, and issue ships. When they were forced to beach out from the shoreline because of shallow gradients, they could carry pontoon causeways with them. Intermediate types between shipboard craft and the LST were the LSM (landing ship, medium), a small LST, and the LCT (landing craft, tank), which was essentially a powered barge.

The second basic type of landing vehicle, the amphibian, could be propelled both in water and on land. The caterpillar type, invented by Donald Roebling, was able to cross the shoals and beaches of the Pacific. Two models were employed: the personnel carrier, LVT (landing vehicle, tracked), with a ramp in the rear, which allowed troops to debark quickly under some cover; and the LVT (A), or armored amphibian, which was actually an amphibious tank. The Army developed a vehicle of its own, code named the DUKW, an amphibious truck with a propeller drive in the water and a wheeled drive on land.

Special types of large amphibious ships also were built, mainly for the transport and support of landing craft, such as the LSD (landing ship, dock) and the LSV (landing ship, vehicle), an amphibian carrier. The assault transport or cargo ship carried as many as 9 LCM's and 26 LCVP's.

An important element in an amphibious operation was the shore party, which included the labor for quick unloading under difficult conditions. In the Central Pacific, where troop space in large overwater movements was limited, such labor was performed by a small number of specialized service troops augmented by reserves, although the latter were often called into combat when the unloading phase was at its most critical stage. In the Southwest Pacific the engineer special brigade was employed; it had regiments consisting of a boat battalion and a shore battalion, ably officered and with needed service troops attached.

See also AMPHIBIOUS WARFARE.

**Mobile Logistics.**—The major carrier and amphibious operations in the Pacific could not have been carried out without a highly developed system of mobile logistics. By means of this system ships of the Pacific Fleet were able not only to remain indefinitely in forward areas adjacent to enemy territory, but also to cruise at sea for long periods in readiness for combat. Such mobile logistics enabled combat ships to receive fuel and

other needs from service ships either while under way or at anchorages near operating areas. Advanced base facilities were maintained afloat at all times, and techniques were developed for transferring fuel, ammunition, stores, and personnel at sea, thus freeing combat ships from the necessity of returning to port at frequent intervals.

The maintenance of logistics afloat had two advantages in addition to keeping combat ships at sea: (1) Service craft could move forward relatively easily either under their own power or by towing. (2) Better storage and handling facilities and more accurate inventory control were available than in primitive shore areas. The disadvantage was the great demand for ships.

The primary requirement of a floating base is a large anchorage affording good holding ground and capable of being protected from submarine attack. Adjacent land is required only for fighter strips, recreation areas, and those naval facilities that can perform their functions better on shore. The atolls and islands of the Central Pacific provided such areas, and in the advance across the ocean United States naval forces used the anchorages at Majuro, Eniwetok, and Ulithi. Earlier in the war floating bases were established in conjunction with shore facilities at Nouméa in New Caledonia, Espiritu Santo in the New Hebrides, and Manus in the Admiralty Islands. Afloat bases were later located at Samar in the Philippines and the Kerama-retto near Okinawa.

From its beginning the United States Navy had a tradition of operating with afloat logistics, since historically it was a navy without proper bases even in its own country. Nevertheless, the immensity of the logistic problem in a cross-Pacific war had not been realized in prewar planning. Various reasons may be advanced for this failure, the most logical being the discontinuance of the study of logistics at the Naval War College and the fact that fleet problems could not be made broad enough for the impact of logistics to be felt. As a result, major problems had to be solved just before or during the war. A logistic structure had to be improvised, and the reason that it was done so quickly and so well was that abundance could cover mistakes.

The first conception for providing logistics for the fleet was the establishment of advanced base units on shore. Such units were specially organized in the United States with equipment packaged for erection in forward areas. Designated as Lions (major bases), Cubs (minor bases).

and Acorns (aviation bases), they included construction battalions, boat pools, harbor defense units, repair facilities, and other functional components. These had to be set up in advanced areas and could not readily be moved forward as the war advanced. Cubs were established at Espiritu Santo and Gaudalcanal, and a Lion was set up at Manus. As the war moved closer and more rapidly toward Japan, this conception was largely abandoned.

With the capture of the Marshall Islands in February 1944, the practice of afloat logistics came into its own. Most of the service ships at Pearl Harbor were transferred to Majuro to form Service Squadron 10. This force was a medley of floating equipment, including repair ships, floating dry docks, tenders, provision ships, ammunition ships, hospital ships, station tankers, lighters, tugs, floating cranes, distilling ships, survey ships, cold storage ships, and floating barracks. The largest piece of floating equipment used during the war was the ABSD (advanced base sectional dock), capable of lifting 90,000 tons and docking any ship in the Pacific. Any of its sections (a maximum of 10) could be towed forward separately and be docked by the others.

The second element in mobile logistics during the war was afloat replenishment, which enabled ships to remain at sea longer than steam vessels had ever done before. The continuing requirement was fuel oil, of which a combat ship always required sufficient for battle. The practice in the Pacific therefore was to fuel at sea every three to five days. The technique of such fueling, which had been developed in the United States Navy before World War I, did not change essentially thereafter. Two ships would steam alongside each other, one at a slightly greater speed so as barely to tow the other, and both under rudder control. Fuel would be delivered through flexible hoses that were kept suspended and out of the water between the two ships by booms and running gear. The British Navy, having operated through two world wars largely in the North Sea and with bases elsewhere in the world, had not developed an efficient technique of fueling at sea, and the Royal Navy carrier force that joined the Pacific Fleet in 1945 had to fuel by the slow method of towing in tandem with a floating hose between the two ships. The major replenishment need after fuel was ammunition, for magazine space in combat ships was limited. In the later stages of the war provisions and special stores, replacement aircraft, and even personnel also were transferred at sea.

The replenishment force operated as Service Squadron 6 during the Iwo Jima and Okinawa campaigns. While its composition varied with conditions, it was generally composed of a light cruiser flagship, about 16 tankers, 4 ammunition ships, 4 fleet tugs or salvage ships for towing crippled ships from the battle area, 2 aircraft transports, provision ships as required, and protective escort carriers and destroyer types.

The realization of the importance of mobile logistics was illustrated in the Okinawa campaign by the seizure before the assault landing date of the Kerama-retto, an island group west of Okinawa that had a good anchorage. Mobile logistics was not nearly as essential for ground forces and land-based forces in the Pacific as for naval forces, but it was found that, where sufficient shipping was available, it was preferable to retain supplies afloat until they were needed

ashore. The transfer forward of army bases from the New Guinea coast after the recapture of the Philippines necessitated the withdrawal of a large number of LST's from combat operations.

To move men and materials across two oceans required a complete reorganization of the American merchant marine and a tremendous shipbuilding program. In February 1942, the War Shipping Administration (WSA) was established to provide shipping needs for the war economy and the armed services. Two standard types of cargo ships were built rapidly and in quantity by the American shipbuilding industry: the 10-knot Liberty ship and, later, the 15-knot Victory ship. These ships were then outfitted and manned by shipping companies but were operated by the WSA.

See also SHIPBUILDING INDUSTRY AND CONSTRUCTION.

**Antisubmarine Operations.**—Insofar as future warfare was concerned, the most important naval developments of World War II may have occurred in the North Atlantic, where the struggle for survival of Great Britain was won before the United States offensive in the Pacific began. The victory over the German submarine was mainly the result of British efforts, the United States contribution consisting primarily of mass production processes.

Karl Doenitz (Dönitz), the German admiral in command of submarines, was one of the toughest naval antagonists that the Allies met during the war. He believed that Germany could win only by sinking an average of 750,000 tons of Allied shipping monthly, and his strategy was to keep his submarines moving to areas where sinkings were easiest to obtain. Against convoys he preferred to use heavy concentrations of U-boats known as wolf packs in continuous attacks, directing them individually from his headquarters ashore. The weakness in this method of control was the amount of two-way radio traffic required: Allied high frequency direction finders were able to locate German submarines with considerable accuracy. Wider convoy routing and better antisubmarine precautions in distant areas forced Doenitz to return to the shipping lanes of the North Atlantic, and it was there that the battle was finally settled in the summer of 1943.

The German submarines were defeated by the Royal Navy's battle-scarred escorts and by aircraft of the Royal Air Force (RAF) Coastal Command under the operational control of the Admiralty. British scientists also made contributions to this victory, two of them major: microwave radar and operational research on antisubmarine warfare methods. The British success can be attributed to radar; sonar (asdic in British terminology), high frequency direction finding; the escort carrier; antisubmarine support groups of destroyers, which reinforced the escorts of convoys under attack; and the extension of land-based airpower across the Atlantic by the employment of B-24 Liberators. The principal United States contribution was the escort carrier, used to cover the areas in the mid-Atlantic that land-based aircraft did not reach. Escort groups, consisting of a small carrier and about 4 destroyer types, began operating in June 1943. They were especially successful in locating submarine refueling rendezvous. Hunter-killer groups of this type are still retained in the operating forces of the United States Navy.

The technological advance that proved most



Wide World

In the antisubmarine campaign in the South Atlantic, a B-24 Liberator of the United States Navy straddles a surfaced German U-boat with depth charges.

fruitful for the British in the antisubmarine campaign was microwave radar. German submarines while on the surface were able to detect enemy use of long-wave radar and could submerge in time to avoid attack. They failed, however, to discover that microwave radar was being employed against them until 1944, with the result that surface vessels were able to approach close enough to a submarine before it submerged to get it on the sonar. Coastal Command aircraft were eventually fitted with this type of radar. Used in conjunction with the Leigh light, a powerful searchlight controlled by the radar set, it was able to surprise surfaced submarines, which could be attacked before they submerged.

Late in the war antisubmarine ordnance was radically improved by the introduction of a projectile to augment the depth charge. The mount, called a hedgehog, threw 24 missiles over the bow of the attacking ship. Since the missiles exploded only after one of them had struck the submarine, there was no explosion in an unsuccessful attack to disturb the sonar search and give the submarine time to escape.

Because sailing in convoys delayed shipping, vessels capable of making 15 knots and over sailed singly, with the expectation that faster turnarounds would compensate for submarine losses. Pressure was brought on the Admiralty to sail 13-knot ships singly as well, but this change proved a mistake, and the 13-knot convoys were reestablished in May 1941.

Improved convoy efficiency was finally attained through operational research. By analytical studies of attacks, British scientists discovered that the number of sinkings bore no relation to the size of the convoy and depended only on the number of attacking U-boats, on whether the convoy had air escort, and, when it did not, on the number of surface escorts. Convoys were therefore increased in size from 32 to 54 ships, providing both better protection and faster delivery of cargoes. Air escort during daylight was found to decrease losses by an additional 64 percent, making sinkings negligible.

Late in the war the Germans developed the snorkel, by which a submarine could both cruise and charge batteries underwater with only the extension of this breather pipe exposed. It was perfected too late to affect the German submarine effort and require antisubmarine methods to counter it. But the problem of countermeasures remained with the postwar nuclear-powered submarine, a true submersible able to remain underwater constantly and cruise at great depths with high speed.

See also NAVAL AVIATION—*Evolution of Naval Aviation (World War II)*; NAVAL STRATEGY AND TACTICS; SUBMARINE—*5. History of Submarine Warfare (World War II)*; WARSHIPS.

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### 13. Developments in Air Warfare

**Doctrines of Command and Employment.**—Aviation had little effect on the outcome of the surface battles of World War I because it was still in its developmental infancy. In each major nation after the war, however, civilian and military leaders studied the ideas of such men as Britain's Sir Hugh Trenchard, America's William Mitchell, and Italy's Giulio Douhet. The nations that were to be the major air adversaries of World War II developed plans for organization and aerial equipment which reflected their national objectives and their basic concepts of war.

The Royal Air Force (RAF) of Great Britain was formed on April 1, 1918, by the union of the Royal Flying Corps and the Royal Naval Air Service. Although the British Navy later recovered control of its aviation units, Britain continued to accord aviation coordinate status with land and sea forces. In its rearmament programs after 1936 it felt compelled to emphasize the development of air defense forces to meet the challenge of Nazi Germany's Luftwaffe.

Despite frequent demands for a unified air force, the United States continued to maintain separate Army and Navy air forces, but the organization of the Army Air Forces on June 20, 1941, and the establishment of air representation on the United States Joint Chiefs of Staff gave aviation a status practically coordinate with that of the older services. As a result of war experience, War Department Field Manual 100-20, *Command and Employment of Air Power*, which was issued on July 21, 1943, stated: "Land power and air power are coequal and interdependent forces; neither is an auxiliary of the other." United States Air Corps leaders were able to obtain the development of long-range heavy bombers because of the requirements of hemispheric defense, but they also gave attention to the procurement of aircraft designed to support ground forces.

Although the Luftwaffe was established as an independent equal of the German Army and Navy in 1935, the Nazi high command viewed air forces as valuable chiefly for supporting blitzkrieg ground assault campaigns. The Luftwaffe was equipped chiefly with fast fighters, twin-engine bombers, and transport planes. The other Axis partner in Europe, Fascist Italy, in 1923 created a separate air force that professed to follow Douhet's teachings. Prewar feats of picked Italian aircrews and special airplanes enhanced Benito Mussolini's reputation, but the Italian Air Force had almost no modern aircraft when it went to war in 1940. A few Italian air units



later served with the Luftwaffe when Germany took over military operations in the Mediterranean area.

When World War I ended, France possessed the world's largest and most virile air force, but its strength was eroded by mismanagement at high levels. During the 1930's, French economic mobilization policy did not support the country's foreign policy, and the General Staff chose to develop the Maginot Line and the navy at the expense of aircraft and tanks. France was probably superior to Germany in the caliber of its aircrews and in individual aircraft characteristics in 1939, but the Luftwaffe held an imposing quantitative superiority, which was increased by the dispersion of the French Air Force. In the air-ground battles of 1940 the French air arm inflicted heavy damage on German air and armored forces, but it was too small and was soon destroyed as a fighting force.

Viewing aviation as a supporting force for surface operations, Japan maintained completely separate and seldom cooperative army and navy air forces. Even in the final months of the war, when the home islands were under air attack, the two air arms had separate aircraft warning systems, and each attempted to protect the targets which it judged to be most important. Except for the courage and patriotism of the fliers who gave their lives in futile Kamikaze (q.v.) attacks, Japan contributed little to the development of airpower experience during the war.

The USSR's air forces were organized into a relatively unimportant naval air force and the Soviet Air Force, which both belonged to and was assigned to assist the Soviet Army. As a support force, the Soviet Air Force developed heavily armored fighters and medium bombers. In 1942, Joseph Stalin organized an independent air force, known as the Long-Distance Flying Command (ADD), but it did not receive equipment suited to its mission. By Anglo-American standards the ADD was a force of medium bombers and twin-engine transports.

**Strategic Bombardment.**—In its essentials the concept of strategic bombardment was best stated in Douhet's writings. This concept visualized a defensive role for surface forces, an aerial offensive designed to secure command of the air, and the aerial destruction of an enemy's capacity to support surface forces and its will to continue the war. Douhet believed that command of the air would be established by attacks against enemy aviation facilities and not through aerial fighting. He therefore advocated development of a "battle plane" capable both of defending itself in the air and of destroying hostile ground objectives.

Although the Luftwaffe was not designed for strategic air warfare, Adolf Hitler elected to commit it to the Battle of Britain on Aug. 8, 1940. The Nazi plan was to gain air superiority by destroying the RAF Fighter Command and to employ the German bomber force to soften British coastal defenses, transportation facilities, and population centers in preparation for a combined sea and air-borne invasion of southern and southeastern England. Aided by newly developed radar, the British fighter force proved superior to German bombers, which were inadequately armed and lacked the ability to carry heavy loads of bombs. A series of vacillating decisions by the Luftwaffe commander, Hermann Goering (Göring), also prevented the numerically superior German Air Force from achieving a decisive concentration of



United Press Photo

Striking deep into enemy territory, American bombers make a carefully aimed attack on the Focke-Wulf aircraft plant in Marienburg, East Prussia, on Oct. 9, 1943.

force against any single objective. By December 1940, the Luftwaffe had failed to accomplish its strategic mission and had suffered heavy losses. In its subsequent campaigns against the Soviet Union, it continued to lack long-range bombers and was powerless to prevent the Russians from rebuilding an air force at factories and bases beyond the Ural Mountains. According to the United States Strategic Bombing Survey, the first factor in the ultimate defeat of the German Air Force was that: "The German Air Force was originally designed for direct support of ground operations, and a lack of a long-range bomber force proved a grave strategic error."

Because of the national emphasis on air defense, the RAF Bomber Command was weak at the beginning of the war and was unable to undertake strategic bombing before May 1940. The buildup of American Army Air Forces heavy bombers in Europe was delayed by conflicting requirements of the Allied land campaign in North Africa. Not until Jan. 21, 1943, could the Anglo-American Combined Chiefs of Staff order a combined bomber offensive designed to attain "the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened." As implemented thereafter, the combined bomber offensive employed RAF bombers that flew at night chiefly against area targets and American bombers from Great Britain and Italy that made daylight precision-bombing attacks. Contrary to original expectations, American bombers required fighter escorts to prosecute sustained attacks against heavily defended targets, but early in 1944 a combination of attacks against aircraft facilities and of aerial battles established Allied air superiority over Germany.

Many airpower proponents consider that World War II neither proved nor disproved the validity of strategic air doctrines, since the war was conducted as a series of interdependent air, ground, and naval campaigns. In any assessment

of the results of the combined bomber offensive against Germany, it is certainly important to note that it was related to the Allied ground campaign, which began with the invasion of Normandy on June 6, 1944. Of the 2,700,000 tons of bombs dropped against Germany, only 28 percent fell before July 1 of that year. Only after the successful Allied invasion were the heavy bombers free to attack strategic targets in Germany in full force. Utilizing its tremendous economic potential and displaying good ability to repair and disperse its factories, Germany actually increased its war production during the months of the Allied air attack. War requirements multiplied even more swiftly than production, however, with the result that beginning in December 1944 all sectors of German economic life were collapsing. "The German experience," stated the United States Strategic Bombing Survey, "suggests that even a first-class military power—rugged and resilient as Germany was—cannot live long under full-scale and free exploitation of air weapons over the heart of its territory." After a later and more exhaustive study, the British historians Sir Charles Kingsley Webster and Noble Frankland concluded in *The Strategic Air Offensive Against Germany, 1939–1945* (vol. 3, p. 310, London 1961): "... both cumulatively in largely indirect ways and eventually in a more intimate and direct manner, strategic bombing . . . made a contribution to victory which was decisive."

In the war against Japan, carrier-based aircraft of the United States Pacific Fleet eventually joined the strategic air campaign, but the United States Twentieth Air Force contributed the vast preponderance of the strategic bombing effort against the Japanese home islands. With a limited economy crowded into a few industrial cities and without adequate air defenses, Japan was highly vulnerable to air assault. Nevertheless, strategic bombing had to await the deployment to combat of the new B-29 aircraft, which had a range long enough to reach Japan from available bases. Hurried into combat from airfields in western China, the Twentieth Air Force's 20th Bomber Command initiated strategic air attacks against Japan on June 15, 1944, but the distance was too great and logistical support too scarce for the B-29's when flying from China. Utilizing newly built bases in the Mariana Islands, B-29's of the 21st Bomber Command launched sustained air attacks against Japan on Nov. 24, 1944. During the period March 9–June 15, 1945, these planes flew at night to prosecute heavy incendiary attacks against six principal Japanese urban industrial concentrations. Effectively blockaded by American submarines and under heavy air attack, Japan's leaders were ready to sue for peace (though not unconditionally) in May 1945, well before the USSR's entry into the Pacific war and the employment of United States atomic bombs against Hiroshima and Nagasaki (qq.v.) on August 6 and August 9. "It seems clear," stated the United States Strategic Bombing Survey, "that air supremacy and its later exploitation over Japan proper was the major factor which determined the timing of Japan's surrender and obviated any need for invasion."

#### **Tactical Air Support for Ground Warfare.—**

Other nations had planned to employ aviation in support of their ground forces, but the techniques of the Luftwaffe in Poland, Norway, the Low Countries, and northern France during 1939 and 1940 established a model of effectiveness. Or-

ganized into air fleets (*Luftflotten*) and air corps (*Fliegerkorps*), the Luftwaffe jealously guarded the integrity of its air units, but it made every effort to perform preplanned missions in support of the blitzkrieg. (Only reconnaissance was attached directly to ground units, and this branch of aviation was repossessed by the Luftwaffe in 1942.) Rarely remaining at one airfield more than a few days, the *Fliegerkorps* shifted the mass of their dive bombers and fighters to attack critical targets on any ground front. The stages of the air attacks included strikes against hostile aircraft and enemy airfields, the enemy's communications and main headquarters, and then the enemy's beaten and retreating troops. These corps performed very effectively on the narrow front characteristic of ground operations in western Europe. At the beginning of the campaign against the Soviet Union the German Air Force again achieved striking successes, but the distances soon proved too great and the force available too small. Moreover, the Soviet Air Force rebuilt its strength and countered German blows with telling effect. The Luftwaffe not only was overextended, but also was required to devote most of its efforts to the close support of German ground forces, with a consequent reduction in the effort that could be applied to counter air force and interdiction operations.

In the early campaigns in Europe an RAF component was attached to the British Expeditionary Force, and individual squadrons were often attached to divisions and corps. In January 1943, the United States 12th Air Support Command in North Africa was similarly attached to the United States 2d Corps. Such arrangement negated the inherent flexibility of aviation, and centrally controlled Luftwaffe units easily overwhelmed divided Allied air squadrons. Recognizing that "penny packets" of aviation were ineffective, Gen. (later Field Marshal) Sir Bernard Law Montgomery (later 1st Viscount Montgomery of Alamein), commander of the British Eighth Army in North Africa, acknowledged Air Vice Marshal (later Air Marshal Sir) Arthur Coningham as his equal and permitted the Desert Air Force to be employed as a centrally controlled force. On July 21, 1943, the United States War Department officially accepted this coequality of ground and air forces and provided that the tasks of the new tactical air forces, which were designed to cooperate with ground armies, would be to gain air superiority, to prevent the movement of hostile troops and supplies, and to provide close air support to ground troops. This pattern of air employment was tested in Italy and elaborated in the all-out ground campaigns in Europe after June 1944.

Even though the USSR continued to consider aviation as an auxiliary to ground armies, the actual employment of the Soviet Air Force was similar to that of the Americans and the British. As a rule, one air army served each front (army group) and operated according to the battle plan of the front commander. The Soviet Air Force recognized the tasks of air superiority, isolation of the battle area, and close support. Long-range missions of the ADD were usually coordinated with the requirements of the ground battle.

In the jungle and island battles of the Pacific the broad outlines of tactical air force employment were not unlike those of Europe. Ground invasion troops in these theaters, however, generally lacked sufficient organic artillery, with the result that close air support of ground forces was

f added importance. With a long tradition of ground support, which dated back to the Nicaraguan intervention of 1926-1933, United States Marine airmen developed (especially in the latter stages of the Pacific campaigns) communications, command, and employment techniques that enabled them to give excellent close air support to friendly ground troops.

**Airborne Assault and Air Transport.**—For a nation that had extensive civil experience with air transport and had pioneered in the military application of airlift by ferrying Gen. Francisco Franco's Moroccan troops to Spain in 1936, Germany was strangely ambivalent in the field of transport aviation. The Luftwaffe never consolidated the management of transport under a single chief, and the standard Ju-52 transport fleet not only was used for airlift but provided a substantial proportion of the aircraft employed in Luftwaffe training programs. In operations that proceeded according to schedule, Luftwaffe air transport machinery worked well, as was demonstrated in the employment of air-dropped and air-landed troops in Norway and the Netherlands in 1940 and in the capture of Crete in the spring of 1941. By the winter of 1942-1943, however, German air transport forces were exhausted in a futile effort to resupply the besieged ground armies at Stalingrad (now Volgograd).

At the outset of the war the Soviet Union probably intended to make extensive use of elite airborne troops, but these forces were soon destroyed in ground battles, and such transport aircraft as remained were usually employed in resupplying guerrilla forces. One of the chief missions of the ADD was to fly nocturnal supply drops to partisan troops in forward areas.

The Anglo-American organization of airlift forces placed central control of most such units under a troop carrier headquarters, which could employ the transport planes either for airlift or for air assault operations. Allied airborne assaults accompanied invasions in North Africa in November 1942, in Sicily in July 1943, in Normandy in June 1944, in southern France in August 1944, in the Netherlands in September 1944, and across the Rhine River in March 1945. The First Allied Airborne Army, which commanded both airborne divisions and troop carrier wings, managed the two last-named operations. In the Pacific theater smaller regimental-sized air assault operations were conducted at Nadzab, New Guinea, in September 1943 and at Tagaytay Ridge and Corregidor in the Philippines in February 1945. Both aerial resupply and air assault operations were vitally important under jungle warfare conditions in the recapture of Burma, the most striking single operation being Operation Thursday, the fly-in of Maj. Gen. Orde C. Wingate's Special Force into central Burma in March-April 1944.

When not employed in air assault operations, British and American troop carrier forces in all theaters hauled high priority supplies to forward airfields and evacuated sick and wounded men to rear-area hospitals on their return trips. In each Anglo-American theater of war the allocation of cargo space was managed by some form of central air transport control agency, which set priorities in terms of the immediate requirements of the theater.

port developments were almost entirely American. The Army's Air Transport Command reached from the United States into every combat theater

with scheduled flights, while the Naval Air Transport Service centered its operations in the Pacific. Flying the "hump" route across the Himalaya, the Air Transport Command's India-China Division delivered critically needed supplies to otherwise inaccessible China. On return trips to the United States both Army and Navy air transport planes brought sick and wounded men to hospitals near their homes. Air Transport Command crews also ferried replacement aircraft to combat air forces in various theaters.

**Science and Air Warfare.**—"Wars are fought with weapons based on fundamentals discovered during the preceding years of peace," wrote Dr. Theodor von Kármán in 1945. During World War II tremendous new scientific developments—electronics, jet propulsion, missiles and rockets, and nuclear weapons—influenced the conduct and potential of air warfare. The scientific fundamentals of each of these developments were known to all combatants well before the war, but their adaptation to military purposes depended on the initiative and productive capabilities of the belligerent nations.

The working principles of the branch of electronics known as radar (radio detection and ranging) were well understood in the early 1930's in the United States, Great Britain, and Germany. Only the British, however, expedited the construction of a chain of radar early warning stations, which enabled an inferior force of RAF fighters to meet and defeat superior numbers of the Luftwaffe in the Battle of Britain. Radar facilitated offensive fighter control and accurate antiaircraft artillery direction, thereby reducing the ability of bombers to reach their targets. On the other hand, additional developments in radar enabled aircraft to perform precision bombing at night or in bad weather, thus increasing the capabilities of offensive aviation. Every phase of air operations also demanded the utmost development of other forms of electrical communications, and by the spring of 1945 about 12.5 percent of United States Army Air Forces personnel was assigned to some phase of electronics activity.

One of the almost inexplicable puzzles of the war was the fact that early in the conflict Germany had air weapons within its grasp that might have redressed its growing aerial inferiority, and yet its Nazi masters failed to pursue their development. Arrogant after the defeat of Poland, Hitler refused to order full mobilization of Germany's economic potential for war until it was too late, and in 1940 he severely curtailed the development of new weapons that could not soon be available for combat. As a result of low development priorities and Allied bombing attacks, the Germans did not begin to employ their V-1 and V-2 missiles until June-September 1944, when the war was entering its final act. Because of indecision as to priorities and Hitler's insistence that the plane must carry bombs, the Me-262 jet fighter was not put into series production until November 1944. The operational employment of this new jet aircraft (superior by far to any Allied fighter) was too late to have any decisive influence on the air war.

Before the war strategic air warfare enthusiasts had overestimated the effect of air ordnance on urban and industrial targets. They had assumed erroneously that air attacks would easily break an enemy people's will to continue a war. Both in Europe and in Japan repeated air at-

tacks and many tons of conventional bombs were required to neutralize war production facilities. A prior establishment of air superiority had proved necessary to the prosecution of effective strategic bombing attacks. Unknown to many air leaders, the United States began to explore the possibilities of nuclear fission weapons shortly after Dr. Albert Einstein informed President Franklin D. Roosevelt on Aug. 2, 1939, that such weapons seemed practicable. Headed by Maj. Gen. (later Lt. Gen.) Leslie R. Groves, the Manhattan Engineer District produced the Hiroshima and Nagasaki weapons dropped by the Army Air Forces' 509th Composite Group in August 1945. The detonation of these first nuclear bombs not only hastened Japan's decision to surrender, but also represented a "quantum jump" in strategic air capabilities, which appeared fully to substantiate the Douhet concept of strategic bombardment. How these new and terrible weapons—which ultimately would be deliverable with little or no warning by intercontinental jet bombers and ballistic missiles—were to be utilized would be the complex problem facing military strategists in the years following World War II.

See also sections on the various theaters of operations; AERONAUTICS—1. *History* (World War II); ATOMIC WEAPONS; GUIDED MISSILES—*Early Missiles*; JET PROPULSION—*Historical Development*; MILITARY AERONAUTICS; NAVAL AVIATION—*World War II*; RADAR—3 *History*; ROCKETS—*Liquid-Fuel Rockets* (German Rockets).

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#### 14. Diplomatic History

The history of diplomacy in World War II naturally unfolds in three major divisions: the first is the story of the expansion of the war from 1939 through 1941; the second describes the period of transition from 1941 through 1943, when the Axis powers exploited their conquests but also suffered reverses; and the third tells of the Allied search for agreement on postwar policies, producing rising tension within the coalition as it approached victory, 1943–1945.

##### EXPANSION OF THE WAR: 1939–1941

**Poland, the Baltic States, and Scandinavia.**—The Nazi-Soviet cooperation that had enabled Adolf Hitler to launch World War II was strengthened in the first phase of that conflict. On Sept. 17, 1939, Soviet forces moved into Poland, and on September 28 the German and Soviet foreign ministers, Joachim von Ribbentrop and Vyacheslav M. Molotov, revised the terms of the Nazi-Soviet Pact of August 23. The USSR conceded to Germany control over a slightly larger portion of Poland, and in exchange Germany recognized a Soviet sphere of influence in Lithuania as well as in Estonia and Latvia. The new German-Soviet frontier through Poland approximated the one generally known as the Curzon Line (q.v.). A Polish government in exile, established first in Paris and later in Angers, moved to London in 1940. There it organized émigré troops for the Allied cause and endeavored to promote the revival of a large Polish state after the war. Meanwhile, Joseph Stalin did not delay in collecting the other territories that Hitler had allotted to him. On Sept. 28, 1939, under Soviet military pres-

sure, Estonia signed a nonaggression pact granting the USSR naval and air bases. Similar concessions were won from Latvia on October 5, and from Lithuania on October 10.

The Finns caused Stalin greater difficulty. On October 12, the USSR offered to trade Soviet territory for strategic Finnish areas, but negotiations were broken off on November 9, and on November 30 the Soviet Army struck at Finland. The republic's stubborn resistance aroused much sympathy in the West. Great Britain and France considered intervention, the League of Nations expelled the USSR, and Americans discussed the severance of diplomatic relations with the Soviet Union. On March 12 however, before any assistance materialized, the Finns were forced to accept Soviet peace terms. As shown in Map 3, the USSR acquired the entire Karelian Isthmus, islands in the Gulf of Finland, territory northeast of Lake Ladoga, and a strip of central eastern Finland, as well as a 30-year lease on the Hangö (Hanko) Peninsula for use as a naval base and transit rights to Sweden and Norway.

In the meantime, in February and March, Anglo-French diplomacy sought unsuccessfully to win Norwegian and Swedish approval of a proposed Scandinavian front. But it was Germany rather than the Allies that opened the Scandinavian campaign, on April 9 launching simultaneous attacks on Denmark and Norway without diplomatic preliminaries. Within hours the Danish cabinet and king agreed reluctantly to German occupation of their country. Britain and France sent troops to Norway, but the last of the Allied forces were evacuated on June 8. Organized Norwegian resistance ceased, and the king and cabinet set up a government in exile in London.

**German Mastery over Western Europe.**—Until May 1940, the war in the west was peculiarly inactive. Addressing the Reichstag on Oct. 6, 1939, Hitler stated that the acquisition of colonies was his only remaining ambition. While vowing that the "Poland of the Versailles Treaty will never rise again," he proposed a peace conference. The response of Premier Édouard Daladier and Prime Minister Neville Chamberlain was cold. During the Polish campaign and even while making peaceful overtures, Hitler was planning attacks on France, Luxembourg, the Netherlands, and Belgium. When German forces drove into these nations on May 10, Berlin tried to persuade the Low Countries to accept German protection of their neutrality. The German diplomatic overtures failed, but German military success was swift. Luxembourg fell in a day, and the Netherlands capitulated in five days. Meanwhile, the Dutch royal family and cabinet left for London to form a government in exile, which thereafter concerted its policy with that of Great Britain and the United States for the protection of its possessions overseas. Belgium capitulated 18 days after the attack of May 10. Its king, Leopold III, surrendered against the advice of his ministers with only a few hours' notice to the British and French, and it was left to the Belgian premier to establish a government in exile.

In London, Winston Churchill had replaced Chamberlain as prime minister on May 10, but for the moment this step failed to improve Anglo-French fortunes. Virtually all of the British troops in France, as well as some French

and Belgians, were evacuated from Dunkerque by June 4. Meanwhile, the Germans advanced across northern France. They entered Paris on June 14. Premier Paul Reynaud resigned on June 16, and the next day his successor, Marshal Philippe Pétain, sought an armistice. The French accepted the German armistice terms at Compiègne on June 22. The northern and western half of France, including the entire Atlantic coast south to the Spanish frontier, was to be occupied by Germany. The French Fleet was not permitted to join the British to continue the war, but was to be demobilized and disarmed. Approximately 1,500,000 French prisoners of war were to remain German captives—hostages for the good behavior of France—until the end of the war. Although Free French leaders would soon rally around Gen. Charles de Gaulle in London and work with the Allies, the pliant government of Pétain continued to function in France, establishing itself at Vichy because Paris was in the zone of German occupation. The armistice left Hitler in control of Europe from the Vistula River to the Atlantic Ocean and from the Pyrenees to the Arctic Circle.

**Intervention of Italy.**—Two days after the ceremony of June 22 at Compiègne, an emptier one was staged in Rome, giving Benito Mussolini the right to occupy a tiny area in southeastern France and creating a demilitarized zone 50 kilometers wide on the Italian frontier. The duke's meager reward matched his contribution to the victory over France. In 1939 he had avoided entering the conflict. Now, on June 10, 1940, with French defeat assured, he had declared war on France and Great Britain with the approval of King Victor Emmanuel III. His 32 divisions had soon been halted when they moved against the French, and Hitler would not approve his request for an Italian occupation of the Rhone Valley, Toulon, and Marseille. The armistice left Italy with almost nothing to show for its first military effort in support of the Axis.

**Diplomatic Reverses for the Axis Powers.**—In the summer of 1940, Hitler let it be known publicly and privately that he was prepared to make peace with Britain if she would restore the colonies that Germany had lost in 1919 and renounce any influence in continental Europe. When the British showed no interest in his proposals even after they had been made in public on July 19, he intensified his planning for a direct assault on Britain, and by early September a German invasion force was held in readiness on the French coast. But German efforts to achieve air superiority in the Battle of Britain and the necessary naval strength fell short of success, and Hitler renounced an invasion in 1940.

Setbacks in the war against Britain required Germany to undertake new diplomatic maneuvers. On September 27, Germany, Italy, and Japan formalized the Axis coalition by signing the Tripartite Pact in Berlin. Under its provisions, Japan recognized the new order that Germany and Italy were creating in Europe; Germany and Italy recognized Japan's right to create a new order in the Pacific region; and all three nations pledged themselves to form a military alliance against any power that might enter the war against one of them (it was well understood that this provision was directed

against the United States). But the pact did not disguise the fact that Hitler's plans for vanquishing Britain had failed.

Hitler's inability to counter British defiance, obvious by October, had other major repercussions. The policies of Portugal and Spain, for example, were unavoidably affected. Both nations, previously on good terms with Berlin, refused to respond to attempts to bring them into the war on the Axis side. Pétain, too, thwarted Hitler by declining to engage France in military action against Britain. And in Florence on October 28, in a conference with Mussolini, the führer met fresh disappointment. The duke had wished to strike for territorial gains in the Balkans when he entered the war in June, but Hitler, who had his own plans for the peninsula, held him back. The Italian dictator greeted the führer in Florence with the proud announcement that Italian troops had crossed the Greek frontier at dawn. Although Hitler feared that this step would provoke British intervention in the Balkans, he could only contain his rage and return to Berlin.

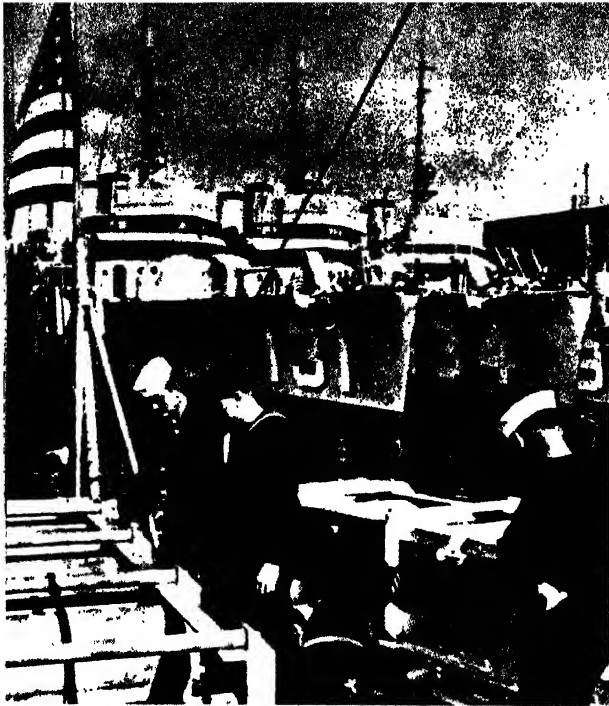
**Nazi-Soviet Friction.**—There were further disturbing developments for Hitler in November 1940. In that month he reached a stalemate in his negotiations with the USSR, and in crucial conferences with Molotov was unable to buy him off. Hitler's cooperation with the Soviet Union had been rewarding. It had hastened Poland's fall in 1939. It had also brought economic advantages: by June 1940, 22 percent of all German imports were received from the Soviet Union and the Baltic states. But tension had arisen between Berlin and Moscow. Just when German troops were most deeply committed in the west and Hitler could not prevent Soviet expansion, the Kremlin used military pressure to incorporate the three Baltic states in the Soviet Union (June 15–Aug. 6, 1940). At the same time, the USSR moved against Rumania. On June 23, the day after the French surrendered at Compiègne, Molotov informed Germany that the Bessarabian question must be settled at once. The Nazi-Soviet Pact of August

Vyacheslav M. Molotov signs new pact of Sept. 28, 1939, as Joachim von Ribbentrop (left) and Joseph Stalin watch.

Etablissement Cinématographique des Armées







Wide World

On one of the 50 United States destroyers traded to Great Britain in 1940 in exchange for military bases, American sailors show British sailors how depth charges are laid.

1939 had promised the USSR a free hand in Bessarabia, but now Molotov laid claim to Bucovina, which had not been recognized as part of the Soviet sphere of influence. Berlin remonstrated with him, and on June 26 the Soviets agreed to limit their demands to Bessarabia and the northern portion of Bucovina. On June 28, the Soviet Army moved into the coveted areas, which were immediately incorporated in the USSR.

Hitler was now determined to prevent further Soviet expansion in central-eastern Europe. Ignoring the fact that the Nazi-Soviet Pact had placed Finland in the Soviet sphere of influence, Berlin on September 12 concluded an agreement with Helsinki that permitted its troops to cross Finnish territory to Norway. On November 20, Hungary joined the Tripartite Pact, and Rumania and Slovakia followed its example on November 22. While the original pact had been directed against the United States, the new additions obviously formed an anti-Soviet bloc.

There was more reason for Stalin to become alarmed than the Soviet dictator realized. On July 31, Hitler had ordered his generals to prepare for a possible invasion of the USSR in May 1941. Before committing himself to war with the Soviet Union, however, he seems to have determined to make a last attempt to reach an agreement that would keep the USSR out of the Balkans and direct its energies against the British Empire. On Nov. 12, 1940, Molotov arrived in Berlin for important negotiations. When Hitler and Ribbentrop proposed that the USSR move toward the Indian Ocean against the British positions in Iran and India, Molotov demanded instead that German troops be withdrawn from Finland, indicated that the USSR planned additional annexations there, requested that Germany's guarantee of Rumania be revoked, and insisted that the Soviet Union had

greater interest in Rumania, Hungary, Bulgaria, Turkey, and the Dardanelles than in expansion toward the Indian Ocean. The meetings ended inconclusively, and on December 5, Hitler approved plans for an attack on the USSR that were embodied in the directive of December 18 for Operation Barbarossa. The attack was to be ready by May 15, 1941.

In the next few months diplomatic and military preparations for the invasion of the USSR were pressed forward. In December 1940, in order to clear his southern flank, Hitler approved plans to move German forces through Bulgaria to aid Italy against the Greeks. Bulgaria came under effective German domination in February 1941, and signed the Tripartite Pact on March 1. Yugoslavia, which had already presented difficulties to German planners, now became even more troublesome. On March 22, Ribbentrop gave Belgrade until the next day to agree to enter a pact with Germany. After agonizing deliberation the Yugoslav government signed the Tripartite Pact in Vienna on March 25, but on March 26-27, Serb patriots revolted against the regency government of Prince Paul and proclaimed the adolescent King Peter II of age. That afternoon, Hitler ordered an early attack on Yugoslavia, and on April 6 German bombers struck at Belgrade. Within 11 days the German Army, aided in the north by many Croats, was in control of the country. King Peter and his ministers left Yugoslavia to create a government in exile. Meanwhile, Croatia was proclaimed an independent state and functioned thereafter as an Axis satellite. Germany and Hungary annexed large portions of Yugoslav territory in the north and east, while Italy acquired more than either of them, including the greater part of the coast. In addition, Bulgaria annexed a sizable area of Yugoslav Macedonia.

In Greece the sequel to the German invasion of Yugoslavia was soon completed, and Athens itself fell on April 27. Greece proper was subjected to joint German-Italian occupation and deprived of territory. Italy annexed the Ionian Islands and added Greek territory to its holdings in Albania, while Bulgaria was permitted to seize part of Greek Macedonia and Thrace, thereby restoring the frontier of 1913. The Greek government joined others in exile.

Thus, by the spring of 1941 almost all of Europe west of the USSR was under the direct or indirect control of Germany. But the German attack on the Soviet Union was launched a full month later than Hitler had planned. In delaying Germany, Yugoslavia and Greece had made an important contribution to the ultimate Allied victory.

**German Attack on the Soviet Union.**—Aside from Hitler's overt actions, which should have demonstrated to Stalin what was coming, Churchill and President Franklin D. Roosevelt warned the Kremlin of German preparations to attack the USSR. It appears, however, that the Soviet armies were taken by surprise when the German invasion began on June 22, 1941. Hitler did not act alone. On the day of the German attack, Italy and Rumania declared war on the USSR; Slovakia joined them on June 23; Finland followed their example on June 26, and Hungary on June 27. Japan, Hitler's partner in the Far East, remained neutral, and Bulgaria, though occupied by German military missions,

also was formally neutral.

Meanwhile, thousands of miles from the Soviet battlefields, decisions were made that transformed the conflict into a global war, assured the eventual defeat of the Axis powers, and laid the basis for a new balance of power after 1945.

**United States Abandonment of Strict Neutrality.**—In the first months of the war the United States was aroused against the Soviet Union as well as against Nazi Germany, but existing neutrality legislation and isolationist sentiment made it impossible for President Roosevelt to take effective action with regard to either nation. Material aid, even after the lifting of the strict embargo on arms shipments with the amendment of the Neutrality Act of 1937 on Nov. 3, 1939, was limited to what the British and French could purchase for cash and transport without using American ships. Pro-Allied sentiment was intensified by the Nazi victories in the spring of 1940 and by Italy's declaration of war against France and Great Britain in June. Thereafter some weapons and ammunition were made available to the British, British pilots were trained in Florida, and British warships were repaired in American shipyards. Then, on September 3, the White House announced more significant support for Britain: the trade (by executive agreement) of 50 overage destroyers in return for rent-free leases of 99 years on sites for American military bases in Newfoundland, Bermuda, the Bahamas, Jamaica, other Caribbean islands, and British Guiana. Congress adopted the Selective Service Act (signed September 16), authorizing the first peacetime military conscription in American history.

Reelected to a third term as president in November, Roosevelt proposed in December a new form of aid to the Allies, which was adopted by Congress as the Lend-Lease Act of March 11, 1941. With supporting appropriations, the act provided at the outset \$7 billion worth of war materials for nations whose defense the president deemed "vital to the defense of the United States." At the end of March, 69 Italian, German, and Danish ships in American ports and Philippine waters were seized, and approximately 875 seamen were jailed for "attempted sabotage." Other semibelligerent steps were taken by Washington during the first half of the year. Beginning in January, informal military and naval staff talks were conducted by American and British officers, who made tentative plans for joint efforts in the event that the United States should be drawn into war with Germany or Japan. On April 9, by agreement with Denmark's minister to Washington, the United States, fearful that Germany might take over Greenland, occupied the Danish island. From similar motives the United States assumed in July the defense of Iceland that Britain had provided since May 1940. Meanwhile, on May 27, 1941, stressing the dangers of nazism to the Western Hemisphere, Roosevelt proclaimed an unlimited national emergency. On June 14, all German and Italian assets in the United States (and those of other Axis-controlled European countries not previously affected) were frozen. June also saw the closing of all German and Italian consulates in the United States and of American consulates in Germany and Italy.

Hitler's attack that month on the USSR (for which few Americans had previously shown cordiality) brought quick promises of American as well as British aid to the beleaguered Soviet Union. Despite provisions of the Neutrality Act, United States ships were permitted to carry aid goods to Soviet ports. To coordinate joint defense measures and provide a basic declaration of common war aims, Roosevelt and Churchill met in August on shipboard off Argentina, Newfoundland. In the Atlantic Charter (q.v.), issued after the meeting, they subscribed to certain general principles for achieving peace. The two leaders stated that no territorial changes should be made contrary to the wishes of the inhabitants of the territories involved, and they recognized the right of people to choose their own forms of government. Greater freedom of trade and freedom of the seas were affirmed as war aims, as was international cooperation to improve conditions of labor and social security. Armaments were to be reduced, and a "permanent system of general security" was to be created. In addition, the aggressor nations were to be disarmed.

Since midsummer, American naval vessels had been employed to convoy merchant ships bound for Great Britain. Then, on September 11, Roosevelt announced that henceforth naval ships on convoy duty would not wait for hostile action but would take the initiative in attacking Axis war vessels. In carrying out this policy, an American destroyer, the *Reuben James*, was sunk by a German submarine west of Iceland on October 30. On November 13, Congress repealed the most troublesome provisions of the Neutrality Act of 1939, thereby sanctioning trade with Great Britain and permitting American merchant vessels to be armed. Hoping to avoid full-scale intervention by the United States, Hitler and Mussolini (like Roosevelt himself) had refused to be provoked into an open declaration of war. Having moved hesitantly toward belligerency in the Atlantic, the United States found that war came instead in the Pacific.

See also LEND-LEASE.

**Japanese Steps Toward War.**—The outbreak of war in Europe in 1939 at first left Japanese prospects in the Far East relatively unchanged. The situation became much more advantageous for Japan in the early summer of 1940, when Germany overran the Low Countries and France. Indochina, with its resources of rice and rubber, could not rely on support from Vichy France if Japan moved to extend its sway there; the Netherlands East Indies, with its oil, could no longer be effectively protected by the Dutch; and, since Great Britain was hard pressed by Germany, even British Malaya's rubber and the strategic base at Singapore lay exposed to attack as never before in the 20th century. The European war had created a power vacuum in Southeast Asia and the Southwest Pacific, presenting Japan with a unique opportunity for expansion. Only the USSR and the United States could stand in its way, and both powers seemed preoccupied with the war in Europe.

In Washington it was hoped that Japan might be contained by diplomatic and economic measures. Thus, on July 25 and July 31, 1940, the United States in effect placed an embargo on the export of scrap metal and petroleum without a special license and of all aviation gasoline to



Left to right: Kichisaburo Nomura, Cordell Hull, and Saburo Kurusu call at the White House on Nov. 17, 1941.

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Japan, while continuing to permit trade in other commodities. The creation on July 17 of a new cabinet headed by Prince Fumimaro Konoye made uncertain at best the prospects of containing Japan peacefully. The new foreign minister, Yosuke Matsuoka, was ambitious in his objectives and rash in his methods. Late in July, the cabinet reached an agreement on basic foreign policy objectives. The possibility of launching an attack in the south before the end of hostilities with China was discussed. If Japan should strike in the south, an attempt would be made to limit the war to Britain. Since this course might make war with the United States inevitable, however, Japan must prepare thoroughly for that possibility, while endeavoring to keep the United States neutral. The cabinet began at once to implement the new policy. An ultimatum of September 22 was followed by the movement of Japanese troops into northern Indochina. On September 26, immediately after the ultimatum became known, the United States proclaimed a total embargo on the sale of scrap iron and steel to Japan. The next day, Japan entered into the Tripartite Pact with Germany and Italy, having reached the decision to do so before proclamation of the embargo. It was the hope of the cabinet that this step would keep the United States from attempting to block Japanese expansion.

Shortly after occupying northern Indochina, Japan increased its efforts to force Generalissimo Chiang Kai-shek to capitulate. The United States reaction to this campaign, as well as to the occupation of northern Indochina and the conclusion of the Tripartite Pact, was to expand its aid to China. Meanwhile, Japanese pressure on the Netherlands East Indies grew, and by January 1941 there was talk in Tokyo of using force in that area. Because of concern that this pressure might lead to armed conflict with the United States, Japanese intelligence services were ordered to intensify their collection of data on American naval strength and placement. In January, Adm. Isoroku Yamamoto, commander in chief of the Japanese Combined Fleet, secretly suggested the possibility of a surprise attack on

the United States Pacific Fleet at Pearl Harbor. At the same time, United States, British, and Dutch leaders began trying to coordinate defense measures in preparation for a possible attack on the Indies.

The German invasion of the USSR in June gave the Japanese more certain assurance than the neutrality pact that Matsuoka had concluded in Moscow on April 13 that Japan could advance toward the south without concern for the possibility of Soviet action in Manchuria. For Matsuoka, however, the invasion had different implications. For years Japanese militarists had justified their imperialistic policies in Manchuria and China proper as defensive measures against Soviet communism and had looked forward to the day when Japan could attack the USSR. The German invasion presented a unique opportunity for an anti-Bolshevik crusade in Asia, and on June 22, Matsuoka recommended to Emperor Hirohito that Japan make war on the Soviet Union. But now that the moment had arrived for action, it was passed over, and in mid-July, Matsuoka was dropped from the cabinet. Meanwhile, on July 2, an Imperial Conference determined that Japan's first objective in the new circumstances would be to bring the war in China to a successful conclusion, while simultaneously advancing toward the south. Japan would "not decline a war with England and the United States" if this should become necessary to achieve her objectives.

The decisions of July 2 were soon implemented. Under an agreement forced on Vichy France on July 23, Japan occupied southern Indochina. In response, Japanese assets in the United States were frozen on July 25, and similar action was taken by Great Britain and the Netherlands. A new cabinet was formed in Japan on October 18. Gen. Hideki Tojo, minister of war in the Konoye cabinet, retained that position and also became prime minister and minister of home affairs. On November 5, after weeks of high-level discussions, an Imperial Conference decided on a final attempt to reach an agreement with the United States. But if a settlement favorable to Japan was not achieved by December 1, war would begin forthwith.

On November 20, the Japanese ambassador in Washington, Adm. Kichisaburo Nomura, and a special envoy, Saburo Kurusu, were instructed to present Japan's last proposal for a temporary settlement. Under its terms both countries would agree to begin no new armed expansion in Southeast Asia or the South Pacific; Japan would withdraw its troops from southern Indochina on the conclusion of the agreement and from northern Indochina when the war with China was ended; the United States would give Japan a free hand to bring the war against China to a successful conclusion; and it would lift the embargo on strategic exports to Japan, release Japanese assets in the United States, agree to supply petroleum as generously as in the period 1936-1940, and join with Japan to ensure access by both countries to the resources of the Netherlands East Indies. This proposal was an ultimatum. A government that had no concern for the global balance of power might have agreed to it; the American leaders could not. From decoded Japanese messages the United States government knew that rejection of the proposal would very likely be followed by a Japanese resort to war, probably against Southeast Asia. In rejecting the proposal

on November 26, the United States presented a counterproposition. It suggested that Japan evacuate both China and Indochina immediately and recognize Chiang Kai-shek's regime as the only government of China. A favorable trade treaty would be negotiated between Japan and the United States, and Japanese assets would be unfrozen. In addition, the two governments would enter into a multilateral nonaggression pact for the Far East.

On December 1, an Imperial Conference reached a formal decision for war with the United States. A last message to the United States government was drafted in Tokyo, to be delivered in Washington on the eve of the attack on Pearl Harbor. It was not an explicit declaration of war, but a rejection of Secretary of State Cordell Hull's proposals of November 26; it declared that negotiations were being broken off. Because of technical delays in the Japanese embassy in Washington, Hull was given the message by Japan's representative at 2:20 P.M. on Dec. 7, 1941, more than an hour after the first bombs fell at Pearl Harbor.

The specific attack on Pearl Harbor on December 7 came as a surprise to the commanders there and to officials in Washington. It accomplished the formal entry of the United States into World War II. On December 8, Congress declared that a state of war had been thrust on the United States by Japan. In accordance with the Tripartite Pact and in response to Japanese requests, Germany and Italy on December 11 declared war on the United States; Congress reciprocated the same day. The conflict begun by Hitler's invasion of Poland in 1939 was now in fact a global war.

#### FROM AXIS MASTERY TO ALLIED RECOVERY: 1941-1943

From 1941 through 1943 the Allies fought stubbornly, forged weapons, and designed a strategy to wrest the initiative from the Axis. Meanwhile, Axis exploitation of the captive nations served as a constant reminder to the Allied peoples of what was at stake in the global war.

**Greater East Asia Coprosperity Sphere.**—The Japanese leaders knew the value of slogans. Wartime proconsuls pictured Japan as the liberator of Asians from Western colonial rule and appealed to the people whose lands they overran to help them in a common effort. Japan's mission, Tokyo proclaimed, was to build a new order in Asia for the Asians. The Japanese named their far-flung dominion the Greater East Asia Coprosperity Sphere (see Map 35). The reality of Japanese rule was considerably less appealing than the propaganda. The pattern of Japanese dominance had long been established in Korea, where a systematic policy of Japanization was pursued. In Manchuria, which had been taken from China in 1931 and renamed Manchukuo, a similar pattern evolved, although there the Japanese took greater pains to erect a façade of indigenous government. Exploitation was just as obviously the Japanese goal in occupied China. In 1940, Japan chose a well-known Nationalist defector, Wang Ching-wei, as its puppet. Established at Nanking on March 30, 1940, his regime on Jan. 9, 1943, declared war on the United States and Great Britain.

Patterns of Japanese control for several other areas had to be devised after the expansion of 1940-1941. British Malaya was kept under direct

military administration and scheduled for eventual incorporation in the Japanese Empire. The Netherlands East Indies also remained under Japanese military administration, but Indochina escaped such rule until March 10, 1945. Thailand, an independent state before 1941, became Japan's ally under duress. Occupied by Japanese troops, it declared war on the United States and Great Britain on Jan. 25, 1942. Thanks to native collaborators, Burma and the Philippines also became allies of Japan. Increasingly, as the fortunes of war turned against them, the Japanese gave lip service to a goal of independence for the captive areas. Nevertheless, the grip of Japan was always maintained, and everywhere the native economies suffered. Meanwhile, Nazi Germany was ruling Europe with even greater severity than Japan employed in Asia.

**Hitler's Europe.**—The Nazi wartime empire (see Map 1) was an improvised makeshift, but it gave Adolf Hitler power that no modern European had ever held. Areas that had been parts of pre-1918 Germany and others that had large German-speaking populations were incorporated directly in the Third Reich. The incorporated territories were Austria; the Sudetenland; northwestern Poland, including Danzig, the Polish Corridor, and Posen (Poznań); and Eupen, Malmédy, and Moresnet, taken from Belgium in 1940. Other provinces—Alsace, Lorraine, Luxembourg, northwestern Yugoslavia, and northwestern Poland (Province of Białystok)—were not considered ready for full incorporation but were earmarked for eventual merger in the Reich. Approximately half of central-eastern Europe was scheduled to be a permanent Continental colonial realm, including the Baltic states, the Government-General of Poland (about one third of prewar Poland), White Russia, the Ukraine, and the Protectorate of Bohemia and Moravia.

In 1940-1941, German forces overran other territories that Hitler planned neither to incorporate in Germany nor to subordinate permanently as colonies. During the war these states were placed under a military occupation that was said to be temporary; they included Norway, Denmark, the Netherlands, Serbia, Greece, and France. Within these states native governments were allowed to function under varying degrees of supervision by German occupation authorities. Bulgaria, Hungary, Rumania, Croatia, Slovakia, and Finland were satellite allies of Germany. They remained politically subservient, economically exploited, and occupied by German troops. Even Mussolini's regime was subordinated to Berlin, especially after the duke's downfall and reinstallation by Hitler in northern Italy in 1943. In that year, Germany occupied the areas in Albania and Yugoslavia that the Fascist state had previously controlled and added the South Tirol (Alto Adige), which Italy had possessed since 1919, to Greater Germany.

In all the areas except the allied and neutral countries, Germany maintained its control by ruthless terrorism. Even less defensible was the deliberate genocide (q.v.) that German forces practiced in order to fulfill the racist dogmas of the Nazis. By the end of the war, Hitler bore ultimate responsibility for killing possibly as many as 5,700,000 Jews. While furthering the extermination of "non-Aryans," Nazi racial policy fostered the conversion of part Germans to full German citizenship.

By exploiting non-German peoples, Germany

marshaled the human, natural, and industrial resources of the Continent between 1940 and 1944. Its economic realm produced 45 million tons of steel for the German war machine in the year of greatest output, or more than either Britain or the USSR produced. Together, however, the British and the Soviets produced more; and the United States alone, even early in the war, produced as much steel as all of Hitler's Europe. The Nazi empire was to be broken down slowly but inexorably after the war spread to the Soviet Union and the Western Hemisphere.

See also JEWISH HISTORY AND SOCIETY—22. *Social and Economic Developments in the 19th and 20th Centuries.*

**Search for Solidarity in the Western Hemisphere.**—Even before the attack on Pearl Harbor, the United States had begun to mobilize the resources of the Americas in the struggle against the Axis powers. The success that was attained owed much to the Good Neighbor policy of the prewar decade. It also owed something to Axis agents and to the zeal of Latin American Nazis and fascists, whose activities convinced many of their countrymen that the Axis threat was not abstract and remote.

The first collective action by nations of the Western Hemisphere to meet the dangers of World War II had been taken during the first month of the conflict. In the Declaration of Panama, adopted on Oct. 3, 1939, foreign ministers of the 21 American nations south of Canada declared a "safety belt" around the hemisphere, extending from 300 to 1,000 miles from the eastern and western coastlines; the European belligerents were warned to desist from naval and military operations in this area. The foreign ministers of the American republics met again in Havana on July 21–30, 1940, to assess the implications of the Nazi conquests in western Europe. By the Act of Havana of July 30 they proclaimed that, pending final disposition, European colonies in Latin America might be made collective trusteeships of the American republics to prevent unfriendly powers from establishing control over them; any of the republics could act in an emergency while awaiting concerted measures. They also declared that any violation of "the territory, the sovereignty, or the political independence" of an American state by a non-American state should be considered an act of aggression against all of the republics. Canada, a member of the British Commonwealth of Nations, was not represented at the Havana Conference, but on August 17 the United States joined with it in agreeing to create a Permanent Joint Board on Defense, which would plan the security of the northern half of the hemisphere.

When the Japanese attacked Pearl Harbor in 1941, Costa Rica, Cuba, the Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, and Panama immediately declared war on the Axis powers. Meeting in Rio de Janeiro on Jan. 15–28, 1942, the foreign ministers of the American republics resolved that all of them should sever diplomatic relations with the Axis. All did so at the time except Chile, which acted in January 1943, and Argentina, which delayed until January 1944. Mexico and Brazil sent troops overseas to help in the war effort. Argentina's refusal to cooperate with the other republics was the most troublesome facet of wartime diplomacy in the Western Hemisphere and a major problem that confronted the Inter-American

Conference on Problems of War and Peace, meeting at Chapultepec Castle, Mexico City, on Feb. 21–March 8, 1945. With Argentina deliberately excluded, the other republics declared that all were joint guardians of each against any aggression; Argentina was notified that she could be admitted to the future United Nations only if she adhered to the Act of Chapultepec and entered the war. The Argentine provisional government on March 27, 1945, declared war against Germany.

**Consolidation of the Allied Coalition.**—Concerning the policies of the American republics was an important task; maintaining the coalition and directing the energies of the great-power Allies was even more imperative. Berlin and Tokyo, not their own choices, had made them allies, and they would not regain full freedom of decision until their common foes were defeated.

During the week before the German invasion of the USSR in June 1941, Churchill advised Roosevelt of his intention to aid the Soviets when the German attack fell, and Roosevelt promised his support. Shipping difficulties caused Stalin to be dissatisfied with the amount of aid that he received, and after the war Soviet historians would contend that all Western supplies did not exceed 4 percent of the wartime production of the USSR. But the aid given in 1941–1942 came at a time when the Soviet Union needed it most. By mid-1942, Britain and the United States had sent 4,400 tanks and 3,100 planes to the Soviet Union. Quite possibly the Soviet Army could not have held out without them, as Stalin himself seemed to confess at Tehran (Nov. 28–Dec. 1, 1943).

Coordination within the Big Three coalition in 1941–1942 was, as it always would be, imperfect. In July 1941, Churchill failed to persuade Stalin to promise the restoration of the prewar Polish-Soviet frontier. On July 30, however, Moscow established diplomatic relations with the Polish government in exile, which it previously had scorned. Other differences and signs of harmony appeared. In September, Stalin renewed his aggrieved demands for a second front in the west in 1941, and this problem caused Churchill great concern. So, too, did the revelation of Soviet war aims made to Anthony Eden when the British foreign secretary visited Moscow in December. The Soviet proposals served as a reminder that Stalin's approval of the Atlantic Charter had been qualified. The Soviet leaders wanted Britain to agree to their retention of all the territory they had acquired while collaborating with Hitler and somewhat more for good measure. Unwilling to accept all the Soviet proposals and fearful of splitting the coalition if they rejected them, London and Washington adopted a policy of postponement and in public statements gave voice to general principles rather than to specifics.

On Jan. 1, 1942, the USSR joined the United States, Great Britain, China, France, and 21 other countries in signing the Declaration by United Nations in Washington. This pact pledged each participant "to employ its full resources, military or economic," against the Axis powers and to make no "separate armistice or peace with the enemies." Member nations, including the USSR, "subscribed to" the Atlantic Charter, "common program of purposes and principles," although these were not repeated in the declaration. The USSR remained faithful to its new



ality pact of April 1941 with Japan, but this raised no serious problems within the new coalition. To consolidate the Allied coalition an Anglo-Soviet alliance, pledging mutual support against aggression for a period of 20 years, was signed on May 26, 1942. Behind this pact lay Western hopes for friendly relations after the common victory over the Axis.

For the moment, however, Hitler allowed Stalin no security, and the Soviet dictator relentlessly reiterated his demand for an early second front in western Europe. In May-June 1942, Molotov traveled to London and Washington to press this issue. President Roosevelt finally approved a statement, made public on June 11, which implied that a second front would be created in Europe before the end of the year. This insufficiently qualified statement could not be fulfilled, for Churchill and his generals favored giving precedence to an invasion of North Africa over a cross-Channel attack. The North African invasion was launched on November 8.

The reconciliation of the French factions in North Africa was a major task for Roosevelt and Churchill when they met at Casablanca in newly liberated French Morocco on Jan. 14-24, 1943. There the rival leaders of Free France, Generals Henri Giraud and Charles de Gaulle, were now urged to work together. On June 3, their diverse supporters created a French Committee of National Liberation with headquarters in Algiers. This body established its control over French colonies in northern and central Africa and directed an underground resistance movement in France. Gradually de Gaulle asserted his mastery over the committee.

At Casablanca, Roosevelt and Churchill also considered their disagreements on strategy and their relations with Stalin. Their military decisions at this conference were certain to cause greater suspicion and concern in Moscow: an invasion of Sicily would be carried out at an early date, but the invasion of France, so much desired by Stalin, would be delayed, possibly until 1944. Somehow Stalin had to be assured of Western

loyalty without an early second front and without specific political promises. This consideration probably was the dominant motive for the act for which the Casablanca Conference is remembered, the proclamation of a policy of unconditional surrender. After deliberation with Churchill the formula was announced by the president on January 24. Peace could come, Roosevelt said, only by eliminating German and Japanese war power, and this meant "unconditional surrender by Germany, Italy, and Japan." While the public statement may have prolonged the war, this is by no means certain. It avoided bickering within the Allied nations that might have sapped their military energies, and it may well have forestalled serious Soviet efforts for a separate peace with Nazi Germany in 1943, when months passed without a second front in northwestern Europe.

In the spring of 1943 the British urged new delays in the creation of a second front in France, and in the Trident Conference, held in Washington on May 12-25, the Americans reluctantly acquiesced in their desire to invade the Italian Peninsula soon after Sicily was in hand. During the discussion, Churchill hinted at the desirability of limited operations in the Balkans. The American military leaders opposed this suggestion: they would do so again when Churchill and Eden later pressed it with greater vigor. Meanwhile, it was agreed to postpone the cross-Channel invasion until May 1, 1944. A storm of Soviet protests arose when Stalin was advised in June of the Trident decisions. As negotiations developed in August and September leading to the surrender of Italy, other disagreements between London and Washington developed, and Stalin (generally omitted from the decision making) repeatedly aired his suspicions of Western policies. Then Hull and Eden traveled to Moscow for major discussions (Oct. 19-30, 1943) of political aims in the war. They assured the Russians of plans to invade France in the spring of 1944, and tensions within the coalition were eased. When Roosevelt, Churchill, and Stalin themselves met

The Allied Big Three meet at Casablanca (Nov. 28-Dec. 1, 1943): left to right, Joseph Stalin, Franklin D. Roosevelt, and Winston Churchill.



Wide World

at Teheran at the end of November for the first Big Three talks, the Soviet dictator was given more definitive assurances on November 30 that the second front was to be established in France in May 1944. Roosevelt and Churchill also led Stalin to believe that his major political objectives would be achieved at the end of the war. Friendly relations seemed to be firmly established among the three war leaders. In Italy, meanwhile, the events of 1943 had brought the Allies closer to victory.

**First Crack in the Axis: Surrender in Italy.**—Mussolini's control over Italy had been shaken by the Allied victory in North Africa in the spring of 1943. On July 24–25, leading Fascists, generals, and King Victor Emmanuel conspired to remove the duce from power, and a new government was created with Marshal Pietro Badoglio as premier. On September 3, the day Allied troops landed on the Italian mainland, Badoglio's regime signed a secret armistice with the Western Allies. Because German forces remained in the peninsula, hard fighting would continue until April 1945 between German and Allied armies in central Italy. Meanwhile, after the autumn of 1943, armed Italian underground units harried the Germans in northern Italy; in 1944 and 1945 they received increasing assistance from the Allies.

The Italian armistice and political problems in southern Italy created friction among the Allies. On Oct. 13, 1943, the Western Allies permitted the Badoglio regime to declare war on Germany, thus achieving a status of *cobelligerency* with the Allies. The USSR was informed of the various developments but was scarcely consulted. Then disagreements between Washington and London allowed Stalin to exert somewhat greater influence in Italy. On March 13, 1944, the Anglo-American leaders were surprised by the announcement of an agreement between the Victor Emmanuel-Badoglio regime and the USSR. While the British and the Americans were debating the future of the monarchical government, the USSR had given it diplomatic recognition and thus a new lease on life. The Western Allies arranged for Victor Emmanuel to retire in favor of his son, Crown Prince Humbert, in June. Thenceforth they would recognize the monarchical regime until the Italian people decided in favor of a republic in 1946. By their exclusive occupation of Italy, Britain and the United States guaranteed that this state would be linked closely to them in the future.

**False Approaches to Peace.**—The events in Italy in 1943–1944 and German reversals in the Soviet Union stimulated consideration of possible ways to end the war short of total military decision. Japan had not declared war on the USSR and was free to seek a separate peace between that nation and Germany. From March 1942 through September 1944, Tokyo occasionally suggested to Berlin and Moscow the possibility of Japanese mediation, but without success. Separate Soviet overtures were made toward Germany in December 1942, June 1943, and September 1943, but Hitler did not respond. In September 1943, he told Joseph Goebbels that what he wished to win in the East, "Stalin could not renounce." Both in 1943 and in 1944 reports of peace feelers circulated in the capitals of the Western Allies and caused anxiety. Possibly, sensing this, Stalin kept the potentiality of a separate peace open only to enhance his bargaining power.

Other possibilities of shortening the war by political action were explored in these years. Nazi Germany encouraged revolution against the Kremlin, while Moscow used anti-Nazi Germans in the Soviet Union to urge German soldiers and civilians to desert or to rise against Hitler. Both efforts were made with reservations and failed to accomplish the desired results.

Meanwhile, leaders of the anti-Nazi resistance movement in Germany urged British and American representatives to give them encouragement for revolution. Apparently they received very little; certainly they requested much. In general, they wished Germany to retain Austria, the Sudetenland, and part of pre-1939 Poland. They also wanted the Western powers, after making a separate peace with a Germany purged of Hitler, to allow Germany to continue the war against the USSR. The resistance depended on the support of Wehrmacht generals, and the Western Allies were determined to crush German militarism as well as nazism. These considerations were probably more significant than the unconditional surrender policy in causing the unenthusiastic response of the Western powers to resistance overtures. Even without Western encouragement the resistance leaders wounded Hitler in an attempt to kill him on July 20, 1944, and tried to revolt against his regime. Distrusted by the West before July 20 and brutally crushed by Hitler after the unsuccessful revolt, the German resistance movement was not destined to succeed in its efforts to shorten the war.

#### ALLIED WAR AIMS AND POLICIES FOR PEACE 1943–1945

The cross-Channel invasion of June 6, 1944, was followed by a rapid Anglo-American movement through France in late July and August. The Allied armies were often aided by local uprisings of the French resistance. These events altered the relations between de Gaulle and Roosevelt, who had remained unwilling to recognize the Committee of National Liberation as a French government even when the invasion was launched. That had not prevented de Gaulle from proclaiming it the provisional government of the French Republic on June 2. Roosevelt's anger at this *fait accompli* was calmed when de Gaulle visited Washington in July. The United States then gave *de facto* recognition to the provisional government. French units participated after August 1 in the liberation of France, and de Gaulle staged a triumphant parade in Paris on August 26, the day after the city was jointly liberated by French and American forces. *De jure* recognition of de Gaulle's regime was granted formally by Britain, the USSR, and the United States on October 23.—At this time and in the months to come, de Gaulle made plain his determination that France should be treated in all respects as an equal of the great Allies.

The military successes in France, like others since 1943, gave promise that the East-West Allies would be able to write their own terms at the end of the war if they could agree on them. Problems mounted as the cement holding the Allied coalition together—German and Japanese military might—began to crumble.

**Basic Problems.**—Knowledge of Soviet demands in December 1941 had caused Churchill and Roosevelt to avoid agreements on peace terms. At that time the Soviet leaders wanted the British to agree immediately to the reincor-

poration in the USSR of all the territory that Stalin had taken while in partnership with Hitler: Estonia, Latvia, Lithuania, and parts of Finland, Poland, and Bessarabia (they also wished additional Finnish territory and air bases in Rumania). Other Soviet aims seemed to be approximately in harmony with those of the West: Austria, Czechoslovakia, Albania, Greece, and Yugoslavia were to be restored as independent states with as much territory as they had held before being seized by the Axis powers; Poland would gain territory at the expense of Germany; and Germany would be dismembered and curbed in other ways. No suggestion was made that any of these states should be Soviet satellites after the war, and Stalin promised his support for any arrangement Britain might wish to make for the future of France, Belgium, the Netherlands, Denmark, and Norway.

The war aims announced to Eden in December 1941 did not make it appear that Stalin's ambition in the world at large was insatiable. In addition to dissolving the Communist International (Comintern) in May 1943 and stressing patriotism over Communist ideology within the USSR, the Soviet leaders joined those of Britain, China, and the United States in declaring on Oct. 30, 1943, that they would not use their military forces in the territories of other states for selfish political purposes after the war. For their part, Roosevelt and Churchill wished to satisfy the Soviet desire for security, while placing limits on Soviet expansion.

The conflict between Soviet pressures for early agreement on peace terms and Western attempts to limit and delay them can be followed in all the great conferences in which postwar policies were discussed: the foreign ministers' conference, held in Moscow (Oct. 19–30, 1943); the Teheran Conference (Nov. 28–Dec. 1, 1943); the Yalta Conference (Feb. 4–11, 1945); and the Potsdam Conference (July 17–Aug. 2, 1945). Roosevelt died on April 12, 1945, and President Harry S. Truman represented the United States at Potsdam; Clement R. Attlee, who became the new British prime minister during the conference, replaced Churchill.

**Creation of the United Nations.**—Stalin's participation in wartime planning of the future United Nations organization offered hope for friendly East-West relations after the war. Soviet willingness to cooperate was announced in the four-power declaration of Oct. 30, 1943. At Teheran, Roosevelt and Stalin found themselves in general if tentative accord on the broad principles of operation of the new organization. Fleshing out the bare bones of these principles proved to be more difficult at Dumbarton Oaks in Washington (Aug. 21–Oct. 7, 1944). Here it was decided to call the new organization the United Nations. It was to have a large legislative body, the General Assembly, and a small executive committee, the Security Council. In the Council, Great Britain, the USSR, China, and the United States would be permanently represented; they would be aided by rotating members chosen by the Assembly. The right of veto in the Council by the great powers on basic matters affecting their security and sovereignty (a major American provision) won approval, but there was disagreement over the limits to be placed on the use of this right by these powers. This dispute could not be reconciled at once, and a stalemate also was reached on the Soviet de-

mand for 16 seats in the General Assembly.

The search for a suitable compromise was one of the major problems before the Big Three when they met at Yalta in February 1945. At first, Stalin vigorously and stubbornly insisted on the full veto power in all issues before the Security Council. On February 7, however, Soviet approval of the American voting formula was given: no member of the Council, when a party to a dispute, was to vote on resolutions for its pacific settlement; in decisions on procedural matters the great-power members also would lack the veto power. Moreover, the Soviet Union agreed to reduce its demand for seats in the General Assembly from 16 to 3. Churchill, who was sensitive about the then-projected 6-seat representation of the Commonwealth of Nations, favored the revised Soviet proposal, and Roosevelt agreed to it. The decision was reached that a conference to found the United Nations should meet in the United States on April 25, and that France as well as China should have permanent seats with the Big Three in the Security Council.

When the San Francisco Conference convened on April 25, 1945, to organize the United Nations, President Truman learned that Stalin had retreated from the Yalta agreement to limit use of the veto. The question at San Francisco was again whether permanent members of the Security Council could prevent discussion of disputes. Stalin finally agreed to adopt the American position. The USSR also sought to restrict freedom of discussion in the General Assembly, but in the end it agreed that the Assembly could discuss any matters "within the scope of the present Charter." Over Soviet protests, Argentina was admitted to the United Nations. Soviet attempts to secure the seating of Poland failed, for Poland was now governed by a Soviet puppet regime, and the United States refused at San Francisco to allow it membership. The United Nations Charter was adopted unanimously at San Francisco on June 26, but the dispute over the seating of Poland was typical of other problems on which no agreement had been found.

**Poland and Central-Eastern Europe.**—Churchill later described the Polish problem as the "first of the great causes which led to the breakdown of the Grand Alliance." Two major questions disturbed Big Three harmony: What frontiers should postwar Poland have, especially with the Soviet Union? What should be the character of its government?

The question of the Polish-Soviet frontier (see Map 2) was rooted in historical antagonism, the ethnic mixture of the disputed area, the structure of the Polish state between the two world wars, and the growth of Soviet power and ambition. Weak in 1921, Soviet Russia had been forced to agree to a frontier that left 5 million White Russians and Ukrainians inside Poland. In 1939, however, Stalin had gained more than the ethnic Curzon Line by cooperating with Hitler. After 1941 he insisted that the Ribbentrop-Molotov line of 1939–1941 should become the post-war frontier. When the Polish government in exile refused to agree and called for an investigation of the Katyn massacre (see section 3. *Early Campaigns*), Stalin, in April 1943, broke off diplomatic relations with it and groomed pro-Soviet émigrés in the USSR to serve as a future government of Poland. Thus, insofar as the Polish issue was concerned, Churchill was ready even in 1943 to abandon the Western policy of

postponement; seeking to forestall the creation of a Soviet satellite regime, both Churchill and Roosevelt in 1944 urged the London Poles to accept the Curzon Line as a frontier. Their refusal helps to explain why the Soviet Army failed to aid pro-Western Polish patriots who rose against the Germans in Warsaw on August 1. On Jan. 5, 1945, despite Roosevelt's protest, the USSR recognized the pro-Soviet Poles as the government of Poland.

By this time the Soviet Army controlled almost all of the country, and the Yalta Conference was virtually confronted by a *fait accompli*. Stalin argued that his Warsaw regime was as representative as the de Gaulle government in France and the government of Italy, which were backed by the West, but he finally conceded that a few of the London Poles could be associated with the Warsaw regime and agreed that free elections should be held in Poland "as soon as possible." The Big Three also decided that the Polish-Soviet frontier should follow the Curzon Line with minor digressions in favor of Poland. Poland was to receive German territory in the west, although agreement could not be reached on an exact Polish-German frontier. In a Declaration on Liberated Europe, the Big Three promised to support interim governments that were pledged to early free elections in areas taken from Nazi Germany. Thanks to continued Western pressure, in the months after Yalta a few pro-Western Poles were admitted to the pro-Soviet Warsaw regime to form a slightly broader government that the West recognized, but the USSR adhered to its demand that the line of the Oder and Western Neisse (Lusatian Neisse) rivers become the Polish-German frontier. After much discussion the Western leaders at Potsdam agreed that, pending a peace treaty, German territory east of the Oder-Neisse line (except for East Prussia) should be "under the administration of the Polish state."

Meanwhile, on Dec. 12, 1943, the USSR had signed a treaty of alliance with the government in exile of Czechoslovakia amid promises by Stalin that he would not interfere in Czech internal affairs. On Sept. 19, 1944, an Allied-Finnish armistice was signed, restoring the status quo of March 12, 1940, with slight revisions, and leaving Finland free of Soviet occupation. Then, on October 9, Churchill and Stalin privately decided on a division of at least temporary influence in the Balkans as the area was liberated from Germany. The USSR would be predominant in Rumania and Bulgaria; influence would be shared equally in Yugoslavia, where the British had backed Marshal Tito's Partisans since 1943, and in Hungary; and Britain would be predominant in Greece. It was already understood that the Soviet Union was to regain Bessarabia and northern Bucovina. The presence of the Soviet Army after August 1944 in central-eastern Europe ultimately enabled the USSR to control more than the Stalin-Churchill agreement had promised, but Western control in Greece was safeguarded by the British occupation of that country after October.

**Dilemma over Germany.**—While the East-West dispute over the reorganization of the Polish government continued, the Third Reich crumbled under the weight of the Allied advance. Hitler committed suicide on April 30, 1945. Germany surrendered to the Western Allies on May 7 and to the Russians in Berlin on May 9. The

capitulation found the Allies lacking in agreement on a postwar German policy. During the period 1941–1944 the Big Three had seemed to be basically in accord, but by early 1945 fundamental differences had begun to appear. For Stalin the crippling of Germany seemed essential to the attainment of either security for the USSR and or the spread of communism. For Roosevelt and Churchill the German problem was a dilemma that they could not fully solve: How could Germany's domination of Europe be broken without leaving the Continent under the sway of the USSR?

On some policies agreement in principle was easily achieved: Germany must be denazified, disarmed, and demilitarized, and she must surrender war criminals for punishment (all of which required military occupation by the victors); she must pay reparations and have her war industries eliminated or controlled; and she must be reduced in size and either decentralized or dismembered. Formal agreement on these principles was reached unanimously at Yalta; tacit approval had been given much earlier. But behind the agreement on general principles there were massive problems of interpretation. Essential problems remained without clear-cut solutions even after the Big Three parted at Potsdam in August 1945.

Plans for the occupation of Germany were outlined by the British in 1943, negotiated in 1944, and formally approved at Yalta in 1945. As shown in Map 15, the final agreement provided that Britain was to occupy northwestern Germany, the United States the south, and France the southwest; the eastern third of pre-1938 Germany was to be occupied by the USSR. Joint occupation policy was to be defined by a four-power Allied Control Council in Berlin which would thus be occupied jointly by the Allies. Since it was thought that common occupation policies were to be imposed on Germany, no concern was expressed over the fact that jointly occupied Berlin would be surrounded by the Soviet zone of occupation, though Roosevelt in 1943 had favored United States occupation of northwestern Germany up to and including Berlin.

Full agreement on reparations and deindustrialization could never be achieved. In August–September 1944, the United States secretary of the treasury, Henry Morgenthau, Jr., had proposed a program for sweeping deindustrialization and the transfer of plants and equipment to Allied nations as reparations. Roosevelt and Churchill tentatively approved this plan but then retreated from it. At Yalta, Stalin made its principles his own. He proposed that Germany furnish \$20 billion worth of reparations, of which the USSR would receive half; this would be collected by removing 80 percent of Germany's heavy industry in the name of eliminating her war capacity. Since they could not agree, the Big Three decided to create a reparations commission, which would adopt the Soviet demand for \$10 billion in kind as a "basis for discussion." The commission also failed to reach an agreement, as did the Big Three at Potsdam. There they decided that the USSR might receive up to 25 percent of the industry removed from the Western zones of occupation, where most German industry was located, but they could not decide on how much should be removed altogether. The problem was to remain troublesome

throughout the period of occupation, during which the USSR ravaged its own zone and obtained considerable equipment from the Western zones.

Since 1943 the Allies had generally agreed that Germany must cede territory. The restoration of Austrian independence and of pre-1938 Czechoslovakia was undisputed, and no one argued against giving German territory to Poland, but even at Yalta the Big Three could not decide on the amount. In the spring of 1945 the Russians took matters into their own hands and at Potsdam insisted on recognition of the Oder-Neisse line as the German-Polish frontier. The Western leaders reluctantly agreed to recognize Polish "administration" of territory as far west as the "Oder-Neisse Line," pending the formulation of a peace treaty for Germany. Truman and Attlee also agreed "in principle" to the absorption of Königsberg (renamed Kaliningrad) and surrounding territory in East Prussia by the USSR, the definitive frontier to be determined by a future peace conference.

As early as December 1941, Stalin had called for the permanent partition of Germany into separate states. At Teheran both Roosevelt and Churchill indicated their general approval of this suggestion, but they disagreed about the extent of the dismemberment and reserved any final decision. At Yalta, Stalin again pressed vigorously for dismemberment, but again Roosevelt and Churchill thought it too early to make a definitive decision; the Big Three agreed only to "take such steps, including . . . the dismemberment of Germany as they deem requisite for future peace and security." In March and April 1945, Roosevelt continued to favor postponement of a decision in this matter, and on May 9, Stalin proclaimed that the Soviet Union did not intend "either to dismember or to destroy Germany." Asked later that month why he had changed his mind, Stalin told Harry Hopkins that "his recommendation had been turned down at Yalta." Yet, ironically, *de facto* partition was to be accomplished after 1945 by Stalin's refusal to merge his zone of occupation with the Western zones to form a free and united German state. The postwar disagreements over Germany had been clearly foreshadowed at Yalta and Potsdam, but they were not allowed to disrupt the wartime coalition; the defeat of Japan was yet to be accomplished.

**Soviet Aid Against Japan and Far Eastern Policy.**—The likelihood of Soviet participation in the war against Japan and the general character of Soviet aims were foreshadowed by earlier Far Eastern history. In 1875, Russia had surrendered to Japan her claim to the Kuril Islands, and her defeat in the Russo-Japanese War of 1904–1905 had left Japan in control of Port Arthur (Lü-shun), Dairen (Talien), and the railroads of Manchuria (held by Russia before 1905), as well as of Korea (see Map 54). Russia retained control over the northern half of Sakhalin, and in the 1920's established its influence over Outer Mongolia. War against Japan after 1941, if successful, would enable Stalin to win back what the czars had lost and even more unless the West could build a strong China.

The creation of a strong China was to be a frustrating task. In the period 1941–1943 only token American military support could be given to Nationalist China. Chiang Kai-shek, caught up in a civil war with Chinese Communist armies

while fighting Japan, could be dissuaded only with difficulty in 1943 from directing his war effort against the Communists. The latter were as eager to expand the territory under their control as Chiang was to extend his. To chart greater Allied aid to China and to concert political policies, Roosevelt arranged to have Chiang meet with him and Churchill at Cairo on Nov. 22–26, 1943, before the Western leaders went to Teheran. The supply of war materials to Chiang by air across the Himalaya from India was to be increased, and Chiang was treated as an equal of the great Allies. By the Cairo Declaration of Dec. 1, 1943, Roosevelt, Churchill, and Chiang announced their determination to strip Japan of her conquests.

But international political understanding did not solve China's internal weaknesses. In the summer and fall of 1944, Vice President Henry A. Wallace, Ambassador Patrick J. Hurley, and Gen. Joseph W. Stilwell urged Chiang to seek cooperation with the Communists so that the war against Japan could be waged most effectively. Their success was negligible, and Stilwell was recalled in October at Chiang's request. Meanwhile, although American aid was increased, the Nationalist forces yielded more territory to the Japanese. The military failures of China strengthened the desire in Washington for Soviet aid in the war against Japan.

As early as 1941, Roosevelt and Chiang had suggested that the USSR enter the Far Eastern war, but the idea had not been pressed. On Dec. 1, 1943, Stalin informed Roosevelt and Churchill at Teheran that the USSR would declare war on Japan after Germany had been defeated. At the same time he expressed an interest in gaining southern Sakhalin, the Kuril Islands, and use of the Manchurian railroads and Dairen. In December 1944, Stalin again outlined these goals to United States Ambassador W. Averell Harriman and added Port Arthur to the list. Roosevelt and Churchill could not prevent Stalin from obtaining what he requested, and an agreement on these gains might forestall more sweeping annexations. Thus a secret Yalta agreement of Feb. 11, 1945, provided that the USSR should obtain southern Sakhalin and the Kuril Islands; Soviet interests should be preeminent in an internationalized Dairen; Port Arthur should be leased to the USSR; the Manchurian railways were to be operated by a Soviet-Chinese company that would make Soviet interests in the railways preeminent but respect full Chinese sovereignty over Manchuria; and the status quo of Soviet influence in Outer Mongolia was to be preserved. It appeared that Stalin was repudiating the Chinese Communists, for the Yalta agreement stipulated that he was prepared to conclude a "pact of friendship and alliance" with the Nationalist Chinese government. Finally, Stalin agreed to make war against Japan "in two or three months" after Germany surrendered.

At the time of the Yalta agreements, American military leaders desired the entry of the USSR in the war against Japan. The atomic bomb had not yet been tested. Although by July 24, 1945, it was ready for use, the Combined Chiefs of Staff then recommended to Truman and Churchill that they encourage Soviet entry. Meanwhile, fear of Soviet entry and the hope of playing the Soviet Union against the West had prompted Japanese peace efforts through Moscow. In Tokyo, Japanese leaders were willing to



concede the Soviet territorial demands of Yalta and more. At Potsdam, Stalin reported the overtures to Truman and Churchill, who separately agreed to give the Japanese a last warning to surrender.

In the Potsdam Declaration of July 26, the Americans, British, and Chinese threatened heavier attacks if Japan held out. On July 28, Japan announced that it would ignore this warning. Hoping for a change in the Japanese attitude, Truman delayed the use of the atomic bomb on Hiroshima until August 6. On August 8, the USSR declared war (effective August 9). Influenced by this development and by the dropping of a second atomic bomb on Nagasaki on August 9, civilian leaders in Tokyo sought a settlement that would leave the emperor on his throne. The Allied powers quickly agreed, and on August 14, Japan accepted the Allied terms. Meanwhile, Soviet forces had overrun most of the areas promised them at Yalta. On Sept. 2, 1945 (September 1, United States time), the formal Japanese surrender was made to General of the Army Douglas MacArthur on board the battleship *Missouri* in Tokyo Bay. World War II was over.

See also separate biographies of the leading political figures; historical sections of articles on the various belligerents; *INTERNATIONAL LAW—International Law Since World War I*; *NEUTRALITY*; *TWENTIETH CENTURY—Warfare* (World War II); *UNITED NATIONS (UN)*; *WAR CRIMES—War Crimes Trials in Connection with World War II*.

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## 15. Postwar World

The last wartime Big Three conference, held at Potsdam on July 17–Aug. 2, 1945, determined how peace treaties would be drawn up. Instead of an immediate conference like that following World War I, there were to be preliminary meetings of a Council of Foreign Ministers, representing Great Britain, France, the United States, the Soviet Union, and China. Debate could proceed in relative leisure; hasty and ill-considered compromises could be avoided; and when a peace conference finally assembled, it could devote itself to really important issues. Such, at any rate, were the hopes of the Potsdam conferees.

The initial foreign ministers' meetings were, however, disappointing. That in London (Sept. 11–Oct. 2, 1945) dissolved into a wrangle over procedure. Those in Moscow (Dec. 16–26, 1945) and Paris (April 25–May 16, 1946) broke up because of substantive disagreements, particularly concerning the amounts and kinds of reparations to be paid the USSR by Italy, the disposition of the region around Trieste, and the question of whether one of the former Italian colonies in Africa should be assigned to the Soviet Union as a United Nations trusteeship.

### SATELLITE TREATIES

When the Council reconvened in Paris (June 15–July 12, 1946), however, the members were able to reach substantial accord on treaties not only for Italy but also for Bulgaria, Rumania, Hungary, and Finland. Although differences of opinion remained, they agreed to submit these treaties to a general peace conference. Delegates from the 5 nations and the 16 others that had been allied with them assembled in Paris on July 29–Oct. 15, 1946. The Council of Foreign Min-

isters, meeting in New York on Nov. 4–Dec. 12, 1946, compromised remaining points of disagreement. Final texts of the five treaties were signed in Paris on Feb. 10, 1947. As a result of their ratification by the requisite number of states, all came into force on Sept. 15, 1947.

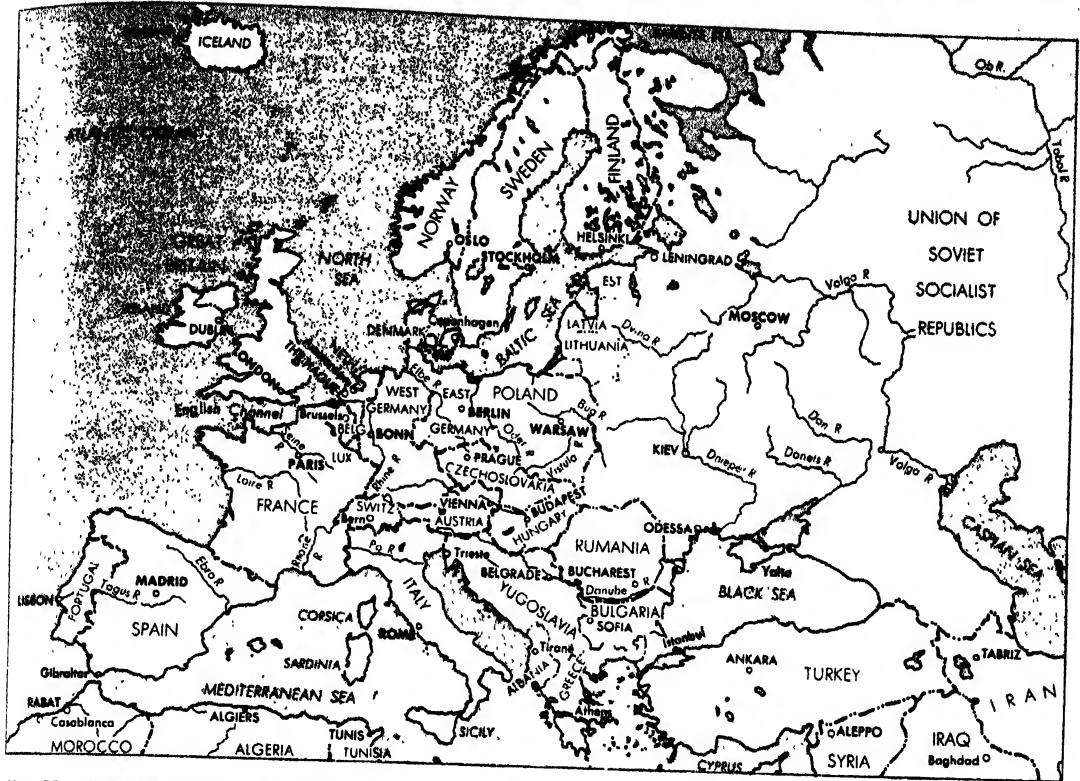
**Italian Peace Treaty.**—The preamble to the Italian treaty contained a war guilt clause somewhat like that which had been included in post-World War I peace treaties. It asserted that Italy had undertaken "a war of aggression and thereby provoked a state of war with all the Allied and Associated Powers and with other United Nations," and that it bore a "share of responsibility for the war." But it also asserted that the principal Allies expected, by the treaty, to settle questions still outstanding, and that they would support Italy's application to become a member of the United Nations.

The treaty's *territorial clauses* provided for minor rectifications of the Franco-Italian frontier, with France to receive the Little St. Bernard Pass, the Mont Cenis (Moncenisio) plateau, and small portions of the Mont Thabor (Monte Tabor) and Chaberton regions, and the upper valleys of the Tinée, Vésubic, and Roya (Roia) rivers. Yugoslavia was to get a small border area south of the boundary between the Italian provinces of Udine (Friuli) and Gorizia, the Province of Zara (Zadar), and the adjacent Dalmatian islands. Greece was to obtain the islands of the Dodecanese, while the Trieste area was to become a free territory guaranteed by the United Nations.

The *political clauses* of the treaty stipulated that Italy should "take all measures necessary to secure to all persons under Italian jurisdiction without distinction as to race, sex, language or religion, the enjoyment of human rights and of the fundamental freedoms, including freedom of expression, of press and publication, of religious worship, of political opinion and of public meeting." No penalties were to be visited on Italian nationals because of wartime partisanship for the Allies. The Italian government undertook to prevent the resurgence of Fascist organizations or any others, "whether political, military or semi-military, whose purpose it is to deprive the people of their democratic rights."

Italy renounced sovereignty over her former colonies, Libya, Eritrea, and Italian Somaliland, agreeing that their final disposal should be determined by the USSR, Britain, the United States, and France or, failing an agreement among those powers, by the United Nations General Assembly. She relinquished all special rights in China and surrendered to the Chinese government the Italian concession at Tientsin and Italian rights in the international settlements of Shanghai and Amoy. Recognizing the sovereignty and independence of Albania and Albanian possession of the island of Saseno (Sazan), she abandoned all special rights in that country and surrendered to the Albanian government all Italian state property there. Similarly recognizing the sovereignty and independence of Ethiopia, she gave up all special claims and rights there and undertook to return all works of art, religious objects, archives, and objects of historical value taken after Oct. 3, 1935. Italy also promised to apprehend and surrender for trial all persons accused of war crimes.

The *military clauses* required the destruction of fortifications on the Franco-Italian and Yugoslav-Italian frontiers and the demilitarization of



Map 55. POSTWAR EUROPE. Territorial changes shown go as far as the partition of the Free Territory of Trieste between Italy and Yugoslavia in 1954.

zones 20 kilometers deep on the Italian side. Pantelleria, the Pelagic Islands, Pianosa, and northern Sardinia were to be completely demilitarized, southern Sardinia and Sicily, partially so. Italy was not to possess, construct, or even experiment with atomic weapons, self-propelled or guided missiles, long-range guns, noncontact mines and torpedoes, manned torpedoes, aircraft carriers, or submarines, and she was forbidden to acquire or manufacture war material beyond relatively limited amounts specified in an annex to the treaty. The warships that she could retain were similarly specified in an annex. Naval personnel were not to exceed 25,000. The army and carabinieri together were not to exceed 250,000. The air force was not to have more than 25,000 men and 350 planes.

**Reparations clauses** provided that Italy should pay the equivalent of \$360,000,000—\$125,000,000 to Yugoslavia, \$105,000,000 to Greece, \$100,000,000 to the USSR, \$25,000,000 to Ethiopia, and \$5,000,000 to Albania. These payments were not to be in money but in goods; surplus war material, capital goods, or, after a period of grace of two years, goods from current industrial production. Quantities and types were to be determined by bilateral negotiation, but it was stipulated that goods should be selected and deliveries scheduled "in such a way as to avoid interference with the economic reconstruction of Italy and the imposition of additional liabilities on other Allied and Associated Powers." While waiving all claims against these powers, Italy also promised to restore to them at her own expense all property that had been taken from their nationals.

In the upshot the Allies were unable to agree on the Italian colonies, and the issue went to the United Nations General Assembly. As a result of votes there, Libya, which had been under British and French administration, became an independent kingdom on Dec. 24, 1951; Eritrea, at first under British administration, federated with Ethiopia on Sept. 15, 1952 (in 1962, Eritrea decided to unite with Ethiopia); and Somaliland, also at first under British administration, became an Italian trusteeship on April 1, 1950, and joined with the Somaliland Protectorate (British Somaliland) to form an independent republic, Somalia, on July 1, 1960. Trieste never became a self-governing territory, for the city and its environs and the Gorizia region to the northwest (Zone A) remained under Anglo-American occupation, while the southern portion (Zone B) continued to be garrisoned by Yugoslav troops, and these arrangements ended only when, on Oct. 5, 1954, Italy and Yugoslavia agreed to a partition. Zone A returned to Italy; Zone B became part of Yugoslavia. Moreover, in December 1951–January 1952, Italy won from 14 of the 21 signers of the treaty consent in principle to a modification of the military clauses, and thereafter the Italian government did not heed them.

**Bulgarian Peace Treaty.**—The Bulgarian treaty had a preamble similar to that of the Italian treaty. Its territorial clause provided simply that Bulgaria's frontiers should be those of Jan. 1, 1941. This meant that the southern Dobruja, which had been transferred to Bulgaria in 1940, would remain Bulgarian. The political clauses referring to civil liberties, the suppression of fascist activities, and the surrender of war crim-

inals were identical with those in the Italian treaty, as were the military clauses relating to new weapons. The Bulgarian Army was not to consist of more than 55,000 men, the antiaircraft artillery force of more than 1,800, the navy of more than 3,500, or the air force of more than 5,200. The navy was to be limited to 7,250 tons; the air force, to 90 planes. Installations for offensive warfare were not to be maintained along the Greek frontier. As for reparations, the Bulgarians were to turn over manufactures, raw materials, and agricultural products to the value of \$70,000,000—\$45,000,000 to Greece and \$25,000,000 to Yugoslavia. In addition, the Soviet Union was to be accorded title to most German assets in the country. Aside from a special clause providing for free navigation of the Danube River, the rest of the treaty was also similar to the Italian.

**Rumanian Peace Treaty.**—The Rumanian treaty was much like the Bulgarian. Rumania's frontiers were to be those of Jan. 1, 1941, thus confirming the cession that had been made to the USSR on June 28, 1940, of Bessarabia and northern Bucovina, and to Bulgaria on Sept. 7, 1940, of southern Dobruja. The only exception was the Rumanian-Hungarian frontier, which was to be restored to the status of Jan. 1, 1938. Northern Transylvania was thus to be returned to Rumania. Among the political clauses was one which had been omitted from the Bulgarian treaty because of that country's relatively good record in regard to racial minorities. This pledged the Rumanian government not to enact laws that should "either in their content or in their application, discriminate or entail any discrimination between persons of Rumanian nationality on the ground of their race, sex, language or religion." Under the military clauses the army was to be limited to 120,000 men, the antiaircraft artillery force to 5,000, the navy to 5,000, and the air force to 8,000, with 15,000 tons set as the limit on the fleet and 150 planes as the limit on the air force. Reparations consisting of \$300,000,000 worth of commodities were to be made over to the USSR within eight years from Sept. 12, 1944, and the Rumanian government joined in promising free navigation on the Danube. Like the Italian and Bulgarian treaties, that for Rumania pledged the withdrawal of Allied forces within 90 days. It made an exception, however, for the Soviet Union, entitling it to keep on Rumanian territory "such armed forces as it may need for the maintenance of the lines of communication of the Soviet Army with the Soviet zone of occupation in Austria."

**Hungarian Peace Treaty.**—The Hungarian treaty was like the Rumanian, including the political clause forbidding discrimination. It restored the frontiers with Czechoslovakia, Austria, Yugoslavia, and Hungary to the status of Jan. 1, 1938, except for the cession to Czechoslovakia of an area across the Danube from Bratislava. It fixed limits of 65,000 men on the Hungarian Army and 5,000 men and 90 aircraft on the Hungarian Air Force. Reparations goods to the value of \$200,000,000 were to be paid to the USSR. Another \$100,000,000 worth was to be divided by Czechoslovakia and Yugoslavia in proportions to be agreed on by those states. In Hungary as in Rumania, Soviet troops were to retain lines of communication to Austria.

**Finnish Peace Treaty.**—Although the United States was not a party to the Finnish treaty, never having declared war on Finland, the document did not differ materially from the others. It

included a political clause forbidding discriminatory legislation. Finland's frontiers were to be those of Jan. 1, 1941, thus confirming the accessions of territory made by the Soviet Union as a result of the Winter War of 1939–1940. In addition, Finland was to cede to the USSR the Province of Petsamo (now Pechenga); and, in return for Soviet renunciation of the right to lease the Hangö (Hanko) Peninsula, to confirm a 50-year Russian lease on a naval base on the Porkkala Peninsula, with appropriate rights of access. The Finnish Army was to be limited to 34,400 men, the navy to 4,500 men and 10,000 tons, and the air force to 3,000 men and 60 planes. In addition, \$300,000,000 worth of commodities were to be transferred to the USSR as reparations.

#### LATER DEVELOPMENTS

Although subsequent foreign ministers' conferences devoted much time to discussion of treaties for Austria, Germany, and Japan, little progress resulted. Even at the time of the signing of the satellite treaties, the United States and the USSR had been drawing apart. Clashes between them in 1947 and 1948 created increasing tension, and by the end of the latter year their relationship was accurately characterized as one of cold war. In 1950 came armed conflict in Korea between Soviet-backed Communist forces on one side and United Nations forces led by the United States on the other.

**Japanese Peace Treaty.**—Meanwhile, the United States government had grown increasingly impatient about maintaining an expensive and, in its judgment, no longer necessary occupation of Japan. Consequently, in 1950 President Harry S. Truman circularized the various governments that had been wartime allies, proposing the drafting of a Japanese Peace Treaty. A special presidential mission then visited many capitals, including Tokyo, and formulated terms that the majority would accept. A conference was called to meet in San Francisco on Sept. 4–8, 1951, and 51 nations, including the USSR, agreed to send representatives. Although the Soviet, Czechoslovak, and Polish delegates refused to sign the treaty, the other 48 delegates did so. An adequate number of governments then ratified the document, and it came into force on April 28, 1952.

Making no reference to war guilt, the preamble merely asserted that the Allied powers and Japan were "resolved that henceforth their relations shall be those of nations which, as sovereign equals, cooperate in friendly association to promote their common welfare and to maintain international peace and security." It stated that Japan would apply for membership in the United Nations and conform to the principles of the United Nations Charter. By the territorial clauses of the treaty, Japan recognized the independence of Korea and renounced all claims to Taiwan (Formosa), the Penghu Islands (Pescadores), the Kuril Islands, the southern part of Sakhalin, and the mandates which she had held from the League of Nations. She stated that she would concur in any United States proposal to make the Ryukyu Islands, the Bonin Islands, the Volcano Islands, Parece Vela, and Marcus Island into United Nations trusteeships under the exclusive control of the United States.

A special set of clauses labeled "security" provided that Japan should "refrain . . . from the threat or use of force against the territorial integrity or political independence of any State"

but also recognized that as a sovereign nation she possessed "the inherent right of individual or collective self-defense" and might therefore enter into collective security agreements with other governments. There were no clauses limiting the Japanese armed forces.

While fixing no sums for reparations payments, the treaty stipulated that any of the former Allies might seize and retain certain assets of Japanese nationals, that similar assets held in neutral countries should be turned over to the International Committee of the Red Cross to be used for former prisoners of war and their families, and that the Japanese government would negotiate with each of her former enemies about making compensation for wartime damage by lending the services of Japanese technicians and workmen.

**Austrian State Treaty.**—In March–April 1955, the Soviet Union unexpectedly indicated that it was prepared to negotiate a treaty for Austria. A conference promptly convened in Vienna; a treaty was signed on May 15; and it came into force on July 27, 1955. Although its preamble treated Austria as a liberated nation rather than as a former enemy, many of the specific provisions were similar to or identical with those in the satellite treaties of 1947. The Austrian government was obliged to prevent the revival of Nazi or fascist organizations and not to enact any discriminatory legislation. The use of Croat and Slovene in schools and official documents was guaranteed for regions where members of these nationalities formed substantial minorities. Although numbers were not fixed for the Austrian armed forces, atomic weapons, guided missiles, and the like were forbidden, and specified limits were placed on the amounts of war material that Austria could possess. While reparations as such were not to be exacted, the treaty gave the USSR a 30-year concession on approximately 60 percent of the country's oil-bearing land and control over most of its refineries. In return for the surrender of certain former German assets, the Soviet Union was also to receive \$150,000,000 in currency. Special clauses forbade any political or economic union of Austria and Germany or even agitation in such a cause; stipulated that the nation should have a democratic government, the secret ballot, and free, equal, and universal suffrage; and directed that a ban be maintained against the return of the house of Habsburg.

After the Austrian State Treaty, progress toward a peace settlement halted again. The Soviet Union and the United States disagreed completely about Germany, and the provisional regimes in the eastern and western zones of that country hardened into permanent governments. While World War II appeared to have brought a final end to the conflict that had begun in 1914, the era after it had some of the characteristics of another long armistice—an armed truce between West and East.

See also historical sections of articles on the various countries; separate articles on the territories that changed hands; *DISARMAMENT—The United Nations*; *FAR EASTERN AFFAIRS—World War II and Thereafter*; *KOREAN WAR*; *PACTS AND CONFERENCES: WORLD WAR II—Council of Foreign Ministers*; *TWENTIETH CENTURY—Warfare*; *UNITED NATIONS, THE (U.N.)*.

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## 16. Chronology

A chronological outline of the major events preceding World War II, the chief military and political occurrences in the various areas during the war, and peace treaties and other postwar developments are presented under the following headings: (1) prelude to war, (2) European and Mediterranean operations, (3) Pacific and eastern Asian operations, and (4) political and diplomatic developments of the war and postwar periods.

### PRELUDE TO WAR

1931

Sept. 18—Japanese begin conquest of Manchuria.

1932

March 1—Manchuria becomes Japanese puppet state of Manchukuo.

1933

Jan. 30—Adolf Hitler becomes chancellor of Germany.

March 27—Japan leaves League of Nations.

Oct. 14—Germany leaves League of Nations.

1934

Jan. 26—Germany and Poland sign 10-year nonaggression pact.

June 30—Hitler carries out blood purge of Nazi Party.

July 25—Unsuccessful pro-Nazi revolt takes place in Austria; Chancellor Engelbert Dollfuss is assassinated.

1935

March 16—Hitler reintroduces compulsory military service.

May 2—France and the USSR sign five-year mutual assistance treaty.

June 18—Anglo-German naval agreement is signed.

Oct. 3—Benito Mussolini invades Ethiopia.

1936

Jan. 15—Japan withdraws from London Naval Conference.

March 7—Hitler remilitarizes Rhineland.

May 5—Italians capture Addis Ababa, ending major operations in Ethiopia.

July 17–18—Spanish Civil War begins.

Oct. 25—Germany and Italy form Rome-Berlin Axis.

Nov. 25—Germany and Japan sign Anti-Comintern Pact.

1937

July 7—Marco Polo Bridge incident near Peiping sets off Sino-Japanese War.

Dec. 12—Japanese planes sink United States gunboat *Panay* in Yangtze River.

Dec. 13—Japanese sack Nanking.

1938

March 13—Hitler annexes Austria.

Sept. 29–30—Munich Conference approves German acquisition of the Sudetenland.

1939

March 15—Hitler occupies rest of Czechoslovakia.

March 28—Insurgent forces complete conquest of Spain.

April 7—Mussolini invades Albania.

Aug. 23—Germany and the USSR sign nonaggression pact.

### EUROPEAN AND MEDITERRANEAN OPERATIONS

1939

Sept. 1—Germany invades Poland.

Sept. 17—Soviet forces invade Poland.

Sept. 27—Warsaw capitulates.

Oct. 6—Last organized Polish resistance is broken at Kock.

Nov. 30—Soviet forces invade Finland.

1940

March 12—Finland capitulates, signing Treaty of Moscow.

April 9—Germans begin invasion of Norway and seize Denmark.

April 14—Anglo-French forces reach Norway.

May 2—Anglo-French forces are driven from central Norway.

May 10—Germans invade the Netherlands, Belgium, and Luxembourg.

May 14—Dutch Army surrenders.

May 20—Germans break through to English Channel at Abbeville.

May 28—Belgium surrenders unconditionally.

June 4—British complete evacuation of Dunkerque.

June 6—Allies leave Narvik.

June 9—Norwegian Army agrees to armistice.

June 14—Germans enter Paris.

June 22—German-French armistice is signed (fighting ends June 25 after signature of Italo-French armistice June 24).

July 3—British attack French Fleet at Oran and Mers-el-Kebir.

July 10—Battle of Britain begins.

Aug. 5—Italians invade British Somaliland (conquest is completed Aug. 19).

Sept. 13—Italians invade Egypt.

Sept. 23—British and Free French attempt unsuccessfully to take Dakar (attack ends Sept. 25).

Oct. 28—Mussolini invades Greece.

Oct. 31—Germans begin breaking off Battle of Britain.

Dec. 9—Gen. Sir Archibald Wavell launches British counteroffensive in Egypt.

1941

Feb. 7—Trapped Italian army surrenders to British at Beda Fomm, Libya.

Feb. 12—Gen. Erwin Rommel arrives in Tripoli to take over North African campaign for Axis.

March 1—Italians finally check Greek counteroffensive.

March 5—British forces reach Greek mainland.

March 16—British land at Berbera, British Somaliland.

March 24—Axis forces launch offensive in North Africa (Tobruk is invested by April 11).

April 6—Axis forces invade Yugoslavia and Greece; British occupy Addis Ababa.

April 17—Yugoslav Army capitulates; British begin evacuating Greek mainland.

April 30—Organized resistance ends on Greek mainland.

May 2—British attack insurgents in Iraq (campaign ends May 31 with occupation of Baghdad).

May 20—Germans begin airborne attack on Crete.

May 31—Germans complete conquest of Crete.

June 8—British attack Vichy French forces in Syria, defeating them in six days.

June 22—Hitler invades the USSR.

Aug. 21—Hitler turns German main effort southward toward Kiev.

Sept. 8—Leningrad's land connections with rest of the USSR are severed.

Sept. 19—Kiev is captured.

Nov. 18—British begin second invasion of Libya.

Nov. 20—Germans capture Rostov.

Nov. 27—Conquest of Italian East Africa is completed with surrender of Gondur.

Nov. 28—Germans are forced to evacuate Rostov.

Dec. 5—German offensive stalls 25 miles from Moscow.

Dec. 6—Russians launch counteroffensive.

Dec. 7—Rommel begins withdrawal to El Agheila.

Dec. 10—British advance in Libya relieves Tobruk.

Dec. 24—British enter Benghazi.

1942

Jan. 2—British capture bypassed fortress of Bardia, Libya.

Jan. 11—Rommel withdraws westward toward El Agheila.

Jan. 17—British reduce bypassed German garrison of Halfaya.

Jan. 20—Russians recapture Mozhaisk, 65 miles west-southwest of Moscow.

Jan. 21—Rommel launches major counteroffensive.

Jan. 26—First United States troops arrive in Northern Ireland.

Jan. 28—British Eighth Army withdraws to El Gazala-Bir Hacheim Line.

Feb. 1—Soviet counteroffensive begins to bog down in German hedgehog defense system.

Feb. 12—German warships *Scharnhorst*, *Gneisenau*, and *Prinz Eugen* escape from Brest and run up English Channel to German ports.

March 27—British carry out successful raid against St.-Nazaire, France.

May 8—Germans begin minor operations to prepare for summer offensive in the USSR.

May 12—Russians launch large-scale spoiling offensive against Kharkov.

May 17—Germans counterattack in Kharkov sector.

May 27—Rommel launches major offensive against El Gazala-Bir Hacheim line.

May 28—Germans complete defeat of Soviet Kharkov offensive.

May 30—Royal Air Force begins major air offensive against Germany with heavy raid on Cologne.

June 10—Rommel forces evacuation of Bir Hacheim.

June 14—British withdraw toward Egypt.

June 20—Rommel breaks into Tobruk, completing its capture June 21.

June 24—Rommel reaches Sidi Barrani, Egypt.

June 28—Germans launch main summer offensive in the USSR.

June 30—British are forced back on prepared positions at El Alamein.

July 1—Germans complete capture of Sevastopol.

July 2—British Eighth Army begins limited counterattacks against Axis forces in Egypt.

July 4—American crews participate in Royal Air Force raid on airfields in the Netherlands, in the first

United States air operation in Europe.

July 6—Germans capture Voronezh, near Don River.

July 9—German offensive in the USSR divides, one army group advancing through Rostov into the Caucasus oilfields and the other toward Stalingrad.

July 23—Germans capture Rostov.

Aug. 9—Germans penetrate northern foothills of the Caucasus.

Aug. 19—British and Canadians, accompanied by small detachment of United States Rangers, make amphibious raid on Dieppe, France.

Aug. 31—Axis forces attack El Alamein position (Battle of Alam el Halfa).

Sept. 7—Lt. Gen. Bernard Law Montgomery halts British counterattack at Alam el Halfa; begins elaborate preparations for major counteroffensive.

Sept. 16—Germans penetrate Stalingrad suburbs.

Oct. 23—British Eighth Army opens El Alamein offensive.

Nov. 1—Heavy fighting continues in Stalingrad and the Caucasus; Russians are gradually wearing down German offensive.

Nov. 5—Axis troops withdraw from El Alamein area.

Nov. 8—British and Americans land in Morocco and Algeria.

Nov. 9—German troops begin occupying Tunisia.

Nov. 10—Adm. Jean François Darlan orders French forces in North Africa to cease resistance to Allied invasion.

Nov. 11—Eighth Army's pursuit crosses Egyptian frontier into Libya, taking Bardia; Axis troops move into unoccupied France.

Nov. 19—Russians begin offensive in Stalingrad area.

Nov. 22—Converging Soviet attacks cut off German Sixth Army around Stalingrad.

Nov. 27—French warships in Toulon harbor are scuttled to prevent seizure by Germans.

Nov. 30—Determined German resistance halts Allied invasion of Tunisia.

Dec. 12—Germans counterattack to relieve Sixth Army at Stalingrad.

Dec. 16—Soviet offensive against Italian Eighth Army on middle Don River forces abandonment of effort to relieve Stalingrad.

Dec. 24—Lt. Gen. Dwight D. Eisenhower, commanding Allied forces in North Africa, decides to postpone Tunisian offensive until end of rainy season.

1943

Jan. 2—German troops in Caucasus area begin withdrawing northward through Rostov.

Jan. 10—Russians begin attack against Stalingrad pocket.

Jan. 12—Russians attempt to raise siege of Leningrad.

Jan. 16—Berlin is raided by Royal Air Force for the first time since Nov. 7, 1941.

Jan. 18—Germans open limited offensive in Tunisia, Russians reopen land communications with Leningrad.

Jan. 23—British Eighth Army occupies Tripoli, Germans break off Tunisian offensive.

Jan. 27—United States Eighth Air Force bombs Wilhelmshaven in its first attack on Germany.

Feb. 2—Last elements of German Sixth Army surrender at Stalingrad; Russian spearheads push energetically toward Rostov, Kharkov, and Kursk.

Feb. 4—British Eighth Army crosses into Tunisia from Libya.

Feb. 8—Russians capture Kursk.

Feb. 14—Germans launch spoiling offensive against United States 2d Corps in Tunisia; Russians capture Rostov.

Feb. 16—Russians capture Kharkov.

Feb. 20—Rommel breaks through Kasserine Pass in Tunisia.

Feb. 21—Germans launch counteroffensive toward Kharkov.

Feb. 22—Rommel begins to withdraw through Kasserine Pass.

March 6—Rommel is repulsed in attack on British Eighth Army near Médenine.

March 12—Russians capture Vyazma.

March 14—Germans complete recapture of Kharkov.

March 17—United States 2d Corps begins offensive in Tunisia.

March 20—British Eighth Army attacks Mareth Line.

March 27—Enveloping attack by British Eighth Army forces Germans to evacuate Mareth Line and retire northward.

April 23—British-United States staff is established in England under Lt. Gen. Sir Frederick E. Morgan to plan invasion of northwestern Europe.

May 4—Final Allied offensive opens in Tunisia.

May 13—Last Axis forces surrender in Tunisia.

May 16—17—Royal Air Force raid breaches Mühne and Eder dams, flooding portions of the Ruhr.

May 18—Air offensive begins against Pantelleria Island to clear way for invasion of Sicily.

June 11—Pantelleria surrenders unconditionally.

June 14—With occupation of Lampedusa in Pelagie Islands, Allies gain control of all islands between Sicily



- and Tunisia.
- June 20—Royal Air Force makes first shuttle-bombing raid between England and North Africa.
- July 22—United States Eighth Air Force makes its first large-scale daylight raid on Ruhr area.
- July 5—Germans launch offensive against Kursk salient.
- July 9—Allied forces invade Sicily; German Kursk offensive is checked.
- July 12—Russians open major offensive against Orel salient.
- July 22—United States Seventh Army takes Palermo, Sicily; Soviet offensive spreads across entire front.
- July 24—United States Eighth Air Force makes its first raid on Norway.
- Aug. 1—Mass, low-level American air raid is made on Ploesti, Rumania.
- Aug. 5—Russians capture Orel and Belgorod.
- Aug. 17—American and British forces converge at Messina, Sicily; United States Eighth Air Force raids Schweinfurt and Regensburg; Royal Air Force attacks German V-weapons experimental center at Peenemünde.
- Aug. 23—Germans evacuate Kharkov; Russians attack heavily on Mius River front.
- Sept. 3—British Eighth Army forces, crossing from Sicily, land on Italian coast; Italian government signs secret armistice (effective Sept. 8).
- Sept. 8—Italian armistice is announced; Italian Fleet and aircraft surrender to Allies.
- Sept. 9—British amphibious assault seizes Taranto; Allied forces land at Salerno.
- Sept. 11—German counterattacks begin in Salerno area.
- Sept. 13—German counterattacks seriously threaten Salerno beachhead.
- Sept. 14—German Salerno attacks are contained.
- Sept. 17—Germans begin fighting withdrawal from Salerno front; Russians take Bryansk.
- Sept. 18-19—Allies occupy Sardinia, following German evacuation.
- Sept. 24—Germans evacuate Smolensk and Roslavl.
- Oct. 1—Allied forces enter Naples.
- Oct. 4—Germans seize Kos, site of only Allied air base in Aegean Sea; Allied forces gain control of Corsica.
- Oct. 6—United States Fifth Army reaches Volturno River in Italy.
- Oct. 12-13—United States Fifth Army carries out assault crossing of Volturno River.
- Oct. 14—United States Eighth Air Force raids Schweinfurt ball-bearing plants.
- Nov. 1—Soviet offensive against the Crimea makes progress.
- Nov. 5—United States Fifth Army begins assault against Winter Line in Italy.
- Nov. 6—Germans evacuate Kiev.
- Nov. 12—Russians capture Zhitomir.
- Nov. 14—Germans launch counterattack in Zhitomir area (recapture city Nov. 19).
- Nov. 15—Attack on Winter Line is halted for regrouping.
- Nov. 20—British Eighth Army attacks on Sangro River front in Italy.
- Nov. 26—Germans evacuate Gornal.
- Dec. 1—United States Fifth Army attacks Winter Line in Liri Valley.
- Dec. 2—Luftwaffe makes effective raid on Bari, Italy.
- Dec. 14—Russians begin winter offensive.
- Dec. 16—Germans evacuate San Pietro Infine, key point in Winter Line.
- Dec. 24—United States Eighth Air Force makes major effort against German secret weapon sites.
- 1944
- Jan. 5—Final phase of Winter Line offensive begins in Italy.
- Jan. 15—Operations against Winter Line are successfully concluded; Russians launch major surprise offensive on Leningrad front.
- Jan. 16—Eisenhower assumes post as supreme commander of Allied Expeditionary Force.
- Jan. 22—Allies begin landing at Anzio, Italy; Germans halt Russians around Vitebsk, though Russians continue gains elsewhere.
- Jan. 23—Americans are repulsed in attempt to force Rapido River in Italy.
- Feb. 3—German counteroffensive against Anzio beachhead begins during night; Allies on main Italian battlefield stall in front of Cassino.
- Feb. 6—Soviet offensive in the Ukraine makes great progress near Nikopol.
- Feb. 18—Anzio beachhead is under extreme pressure.
- Feb. 19—Allied counterattack checks German Anzio offensive.
- March 4—German forces around Anzio beachhead go over to the defensive; first American air raid is made on Berlin.
- March 13—Soviet troops force Dnieper River and take Kherson.
- March 15—Allies make third assault on Cassino; Russians break through German defenses along Bug River.
- March 30—Royal Air Force bombing raid on Nürnberg suffers extremely heavy losses.
- April 10—Russians recover Odessa.
- April 15—Soviet offensive into Poland captures Tarnopol.
- May 9—Russians recapture Sevastopol; United States Eighth Air Force begins attacks on German airfields in northern France.
- May 11—Allies launch major offensive against Gustav Line in drive for Rome.
- May 12—United States Eighth Air Force attacks oil plants in central Germany.
- May 13—French Expeditionary Corps penetrates Gustav Line.
- May 18—Allies capture Cassino.
- May 21—Allied fighter aircraft begin operations against enemy railroads in France and Germany.
- May 23—Allied forces in Anzio beachhead begin breakout offensive.
- May 30—Loading of Allied assault forces for Operation Overlord is begun.
- June 2—United States Fifteenth Air Force begins shuttle bombing between Italian and Soviet bases.
- June 3—Combat loading of troops for Operation Overlord is completed.
- June 4—Allied forces enter Rome; D-day for Operation Overlord is postponed from June 5 to June 6.
- June 6—Operation Overlord begins; Allies land on coast of Normandy.
- June 8—American and British beachheads establish contact.
- June 9—Russians launch offensive against Finns on Karelian Isthmus.
- June 12—Allies capture Carentan in Normandy.
- June 17—French force lands on Elba.
- June 27—Americans capture Cherbourg.
- July 3—United States First Army attacks southward from beachhead (battle of the hedgerows).
- July 8—British enter Caen.
- July 13—Russians capture Vilnyus.
- July 18—United States First Army captures St.-Lo; Soviet offensive is checked at Augustów, but still advances elsewhere.
- July 19—United States Fifth Army captures Leghorn.
- July 21—Soviet offensive crosses Bug River.
- July 25—United States First Army launches major breakout offensive (Operation Cobra).
- Aug. 1—United States Twelfth Army Group becomes operational in France; Polish underground forces revolt as Soviet advance nears Warsaw.
- Aug. 4—Allied forces in Italy halt along Arno River to regroup for offensive against Gothic Line.
- Aug. 7—United States Third Army reaches Brest; Germans launch major counterattack near Mortain; Soviet offensive is generally checked.
- Aug. 10—Having halted German Mortain counteroffensive, United States First Army resumes advance.
- Aug. 13—Allied forces begin closing Falaise-Argentan pocket.
- Aug. 15—United States Seventh Army lands in southern France (Operation Dragoon).
- Aug. 16—United States Third Army captures Orléans.
- Aug. 19—French underground forces begin Paris uprising.
- Aug. 20—Falaise-Argentan pocket is completely closed; United States Third Army crosses Seine near Mantes-Gassicourt; Russians open offensive against Rumania.
- Aug. 23—Rumania surrenders unconditionally.
- Aug. 25—Allied forces enter Paris; attack on Gothic Line begins in Italy.
- Aug. 28—French complete capture of Toulon-Marseille area.
- Sept. 1—Gasoline shortage halts United States Third Army; Germans begin withdrawal from Greek mainland and adjacent islands.
- Sept. 4—British enter Antwerp; truce is established between the USSR and Finland.
- Sept. 6—United States Third Army attacks Moselle River line.
- Sept. 7—United States Third Army begins attacks on Metz.
- Sept. 9—The USSR grants Bulgaria an armistice.
- Sept. 10—Decision is reached to postpone opening Antwerp's port until effort (Operation Market-Garden) has been made to secure a Rhine crossing; United States Third Army begins large-scale Moselle crossing; United States First Army captures city of Luxembourg.
- Sept. 11—Patrols from Overlord and Dragoon forces establish contact near Dijon.
- Sept. 12—German garrison of Le Havre surrenders; United States First Army reaches West Wall.
- Sept. 13—Shuttle bombing between Western and Soviet bases is discontinued.
- Sept. 14—United States First Army reaches suburbs of Aachen; United States Third Army surrounds Nancy; Russians capture Warsaw suburb of Praga, and begin offensive in Estonia and Latvia; United States Fifth Army is repulsed in attacks on Gothic Line in Italy.

Sept. 15—United States First Army breaches West Wall.  
 Sept. 17—Operation Market-Garden is launched.  
 Sept. 18—Germans counterattack British airborne troops at Arnhem, Netherlands.  
 Sept. 19—United States Ninth Army completes mopping up in Brittany.  
 Sept. 20—British force Germans to withdraw from Rimini Line in Italy.  
 Sept. 23—Russians break through German lines to Gulf of Riga.  
 Sept. 25—United States Fifth Army completes penetration of Gothic Line in Italy.  
 Sept. 26—Germans overrun last British units in Arnhem area, ending decisive phase of Operation Market-Garden.  
 Sept. 30—Russians cross Danube in drive on Belgrade.  
 Oct. 2—Germans complete suppression of Warsaw revolt.  
 Oct. 3—British troops land in southern Greece.  
 Oct. 13—British airborne troops are dropped near Athens; Germans begin V-1 attacks on Antwerp.  
 Oct. 14—British troops enter Athens; Russians and Yugoslavs encircle Belgrade.  
 Oct. 15—United States First Army surrounds Aachen.  
 Oct. 18—Russians break into eastern Czechoslovakia.  
 Oct. 20—Belgrade is captured.  
 Oct. 21—Aachen garrison capitulates.  
 Oct. 22—Russians advance from Petsamo, Finland, to Norwegian frontier.  
 Oct. 24—British and Canadians begin clearing approaches to Antwerp port.  
 Oct. 25—Russians enter Kirkenes, Norway.  
 Nov. 4—Channel to Antwerp is opened for minesweeping.  
 Nov. 8—Approaches to Antwerp are completely cleared; United States Third Army begins offensive toward the Saar.  
 Nov. 16—United States First and Ninth armies begin attempt to clear area between Wurm and Roer rivers (Operation Queen).  
 Nov. 19—United States Third Army surrounds Metz.  
 Nov. 20—French First Army breaks into Belfort.  
 Nov. 23—French troops with United States Seventh Army take Strasbourg.  
 Nov. 28—Antwerp port is opened for shipping.  
 Dec. 5—Clashes occur between British troops and Greek factions in Athens.  
 Dec. 6—Russians intensify offensive toward Budapest, Hungary.  
 Dec. 13—Last bypassed Metz fort (Jeanne d'Arc) surrenders to United States Third Army.  
 Dec. 16—Germans open major counteroffensive against United States Twelfth Army Group in Ardennes area.  
 Dec. 19—United States 101st Airborne Division reaches Bastogne; elements of United States Third Army prepare to move north; United States Seventh Army goes on defensive in Alsace-Lorraine.  
 Dec. 21—Germans begin siege of Bastogne.  
 Dec. 23—Soviet forces close in on Budapest; heavy fighting takes place in Lake Balaton area of Hungary.  
 Dec. 26—Tanks of 4th Armored Division of United States Third Army break through to Bastogne.  
 Dec. 27—Roads into Bastogne from the south are opened for trucks and ambulances; Russians complete encirclement of Budapest.  
 Dec. 30—Allied forces begin counterattacks in the Ardennes.  
 Dec. 31—Germans launch offensive against United States Seventh Army in Alsace-Lorraine.

**1945**

Jan. 1—Last major German air raid is made against Allied airfields.  
 Jan. 2—Germans counterattack to relieve Budapest.  
 Jan. 3—United States First Army begins counteroffensive against northern flank of Ardennes salient.  
 Jan. 5—Allied forces in Italy begin regrouping for spring offensive.  
 Jan. 12—Russians launch large-scale winter offensive in Poland (extend it to East Prussia Jan. 14).  
 Jan. 17—Russians capture Warsaw.  
 Jan. 20—French First Army begins offensive in Alsace-Lorraine against Colmar pocket.  
 Jan. 25—German Alsace-Lorraine offensive ends with unsuccessful attack near Haguenau.  
 Jan. 28—Russians complete conquest of Lithuania and envelopment of Königsberg.  
 Feb. 2—United States First Army begins advance to seize Roer River dams.  
 Feb. 4—Allied forces in Italy begin limited operations in preparation for spring offensive.  
 Feb. 8—Canadian First Army begins Operation Veritable to clear area between Maas and Rhine rivers (with subsidiary Operation Blockbuster, successfully completed March 10).  
 Feb. 9—French First Army completes reduction of Colmar pocket.  
 Feb. 10—United States First Army seizes main Roer dam but finds that Germans have destroyed outlet controls.

Feb. 12—Varkiza agreement ends civil war in Greece.  
 Feb. 13—Russians overrun last German position in Budapest.  
 Feb. 16—Russians surround Breslau.  
 Feb. 23—United States Ninth Army attacks across Roer River (Operation Grenade) toward Rhine.  
 March 6—Operation Grenade is successfully completed.  
 March 7—United States First Army completes capture of Cologne; its 9th Armored Division seizes Rhine bridge at Remagen intact.  
 March 15—United States Third and Seventh armies launch coordinated offensive (Operation Undertone) to clear Saar-Palatinate triangle (successfully completed March 25).  
 March 16—Russians begin offensive against Vienna.  
 March 22—United States Third Army makes assault crossing of Rhine at Oppenheim.  
 March 23—British Second Army crosses Rhine (Operation Plunder) in Rees-Wesel area.  
 March 24—United States Ninth Army attacks across Rhine in Dinslaken area; United States Third Army begins similar attack (completed March 25) at Boppard.  
 March 26—United States Seventh Army crosses Rhine near Worms.  
 March 31—French First Army crosses Rhine near Speyer and Gernersheim.  
 April 1—United States Ninth and First armies establish contact at Lippstadt, isolating Ruhr area.  
 April 7—Russians enter Vienna.  
 April 9—Russians storm bypassed Königsberg fortress; British Eighth Army opens major offensive in Italy.  
 April 12—United States Ninth Army establishes bridgehead on east bank of Elbe.  
 April 13—United States Ninth Army seizes second Elbe bridgehead; Russians secure Vienna.  
 April 14—Americans lose one Elbe bridgehead; United States Fifth Army joins in Italian offensive.  
 April 16—Russians begin heavy offensive against Berlin.  
 April 17—United States Seventh Army attacks Nürnberg.  
 April 18—Organized German resistance in Ruhr collapses; United States Third Army patrols enter Czechoslovakia.  
 April 20—United States Seventh Army completes capture of Nürnberg.  
 April 21—Organized German resistance ends in Harz Mountains.  
 April 23—Russians fight way into Berlin; United States Fifth Army begins assault crossing of Po River.  
 April 25—United States First Army patrol makes contact with Russians near Torgau.  
 April 26—British complete capture of Bremen.  
 April 29—British Second Army begins advance from Elbe River to Baltic; United States Fifth Army enters Milan; German Southwest Army Group in Italy surrenders unconditionally.  
 April 30—United States Seventh Army occupies Munich.  
 May 2—British Second Army reaches Baltic, capturing Lübeck and Wismar; Russians mop up Berlin; fighting ends in Italy; New Zealand troops occupy Trieste.  
 May 4—Germans surrender forces in the Netherlands, northwestern Germany, and Denmark (effective May 5); patrols of United States Fifth and Seventh armies meet near Brenner Pass.  
 May 5—United States Third Army begins offensive into Czechoslovakia; German Army Group C surrenders in Bavaria to United States Sixth Army Group.  
 May 6—United States Third Army takes Plzeň, Czechoslovakia.  
 May 7—German High Command surrenders all forces unconditionally at Reims; Russians finally capture Breslau.  
 May 9—European hostilities end officially at 12:01 A.M.

#### PACIFIC AND EASTERN ASIAN OPERATIONS

**1941**

Nov. 26—Pearl Harbor striking force sails from Kuril Islands.  
 Dec. 7—Japanese carrier aircraft attack United States naval base at Pearl Harbor, Hawaii, and nearby Army air bases; Japanese destroyers bombard Midway Island.  
 Dec. 8—Japanese planes raid American air bases in Philippines; Japanese invade Thailand and Malaya; seize Shanghai International Settlement; attack mainland territories of Hong Kong; bombard Wake and Guam.  
 Dec. 9—Japanese invade Gilbert Islands.  
 Dec. 10—Japanese seize Guam and begin landing on Luzon; British warships *Repulse* and *Prince of Wales* are sunk off Malaya.  
 Dec. 11—Attempt by Japanese to seize Wake Island is repulsed; Japanese begin invasion of Burma.  
 Dec. 13—Japanese force British to withdraw from mainland to Hong Kong Island.  
 Dec. 16—Japanese invade British Borneo and Burma.  
 Dec. 18—Japanese invade Hong Kong Island.  
 Dec. 20—Japanese land near Davao, Mindanao, Philippines.  
 Dec. 22—Japanese make major landing at Lingayen Gulf,

- Luzon, Philippines; Chiang Kai-shek offers Chinese troops for defense of Burma; first American troops reach Australia.
- Dec. 23—Japanese overrun Wake Island; Gen. Douglas MacArthur decides to withdraw into Bataan Peninsula, Luzon.
- Dec. 25—Japanese complete conquest of Hong Kong.
- 942
- Jan. 7—American and Philippine forces complete withdrawal into Bataan Peninsula.
- Jan. 11—Japanese begin invasion of Netherlands East Indies.
- Jan. 20—Japanese begin major offensive in Burma.
- Jan. 22—MacArthur orders withdrawal to final Bataan defensive position.
- Jan. 23—Japanese make amphibious landings behind American-Philippine positions on Bataan, but are contained; seize Rabaul, New Britain; and land on New Ireland and Solomon Islands.
- Jan. 24—United States destroyers raid Japanese shipping off Balikpapan, Borneo (Battle of Makassar Strait).
- Jan. 26—Withdrawal to final Bataan defensive position is successfully completed.
- Jan. 27—British forces in Malaya begin withdrawal to Singapore Island.
- Jan. 31—British complete withdrawal to Singapore Island.
- Feb. 1—United States Pacific Fleet attacks Japanese bases in Marshall and Gilbert Islands.
- Feb. 2—Lt. Gen. Joseph W. Stilwell is appointed chief of staff to Chiang Kai-shek.
- Feb. 4—Dutch-United States naval force is badly damaged by Japanese aircraft in Madoera Strait, Netherlands East Indies.
- Feb. 8—Japanese forces break off Bataan attacks to reorganize for future decisive offensive; Japanese gain foothold on Singapore Island.
- Feb. 14—Japanese paratroopers seize Palembang area, Sumatra.
- Feb. 15—Singapore surrenders unconditionally.
- Feb. 18—Japanese seize Bali, isolating Java.
- Feb. 19—Darwin, Australia, is badly damaged by massive Japanese air attacks.
- Feb. 22—President Franklin D. Roosevelt orders MacArthur to leave Philippines.
- Feb. 23—British in Burma are forced back across Sittang River, Japanese submarine shells refinery near Santa Barbara, Calif.
- Feb. 27—Allied naval forces are decisively defeated during attack on Japanese convoy (Battle of the Java Sea).
- Feb. 28—Japanese invade Java.
- March 7—British evacuate Rangoon, Burma.
- March 7-8—Japanese land on New Guinea.
- March 9—Dutch forces surrender to Japanese on Java.
- March 11—MacArthur, family, and staff leave Bataan (reach Darwin March 17).
- March 24—Japanese begin heavy air and artillery bombardment of Bataan and Corregidor.
- April 3—Japanese launch major offensive against Bataan.
- April 4—Japanese carrier task force begins large-scale raid into Indian Ocean, attacking Colombo and Trincomalee, Ceylon, during following week.
- April 9—American-Philippine forces on Bataan surrender; Japanese concentrate planes and artillery against Corregidor.
- April 18—MacArthur assumes command of Southwest Pacific area; Lt. Col. James H. Doolittle leads air raid on Tokyo.
- April 29—Japanese seize Lashio, southern terminus of Burma Road.
- May 3—Japanese occupy Tulagi, Solomon Islands.
- May 4—United States carrier planes raid Tulagi.
- May 5—British invade Madagascar; Japanese make assault landing on Corregidor.
- May 6—Lt. Gen. Jonathan M. Wainwright surrenders all forces in Philippines unconditionally.
- May 7—Battle of the Coral Sea begins (ends May 8).
- May 10—American-Philippine forces in Mindanao, Palawan, and Visayan Islands begin surrendering (process is completed June 9).
- May 20—Japanese complete conquest of Burma.
- June 3—American aircraft from Midway locate main Japanese fleet approaching that island.
- June 4—Japanese are decisively defeated in Battle of Midway (pursuit continues into June 6).
- June 6-7—Japanese land troops on Aleutian islands of Attu and Kiska.
- July 2—Joint Chiefs of Staff order recovery of New Britain-New Ireland-New Guinea area, beginning with occupation of lower Solomon Islands.
- July 22—Japanese land at Gona and Buna, New Guinea, for overland advance against Port Moresby.
- Aug. 7—United States Marines begin landing on Guadalcanal, Solomon Islands.
- Aug. 8-9—Japanese naval task force inflicts serious losses on Allied fleet off Guadalcanal (Battle of Savo Island); Allied naval forces retire from Guadalcanal area.
- Aug. 21—First Japanese assault on Henderson Field, Guadalcanal, is repulsed.
- Aug. 24—United States carrier task force defeats Japanese in Battle of the Eastern Solomons.
- Aug. 25—Japanese begin attack on Milne Bay, New Guinea.
- Sept. 5—Japanese begin evacuating Milne Bay beachhead.
- Sept. 9—Japanese plane (launched from submarine) starts small forest fire near Brookings, Oreg. (this was the only bombing attack on the continental United States during war).
- Sept. 13-14—Japanese launch unsuccessful major offensive on Guadalcanal.
- Sept. 16—Japanese advance against Port Moresby is halted.
- Oct. 11-12—United States naval task force defeats Japanese off Guadalcanal (Battle of Cape Esperance).
- Oct. 13—United States Army units land on Guadalcanal.
- Oct. 14—Henderson Field, Guadalcanal, is temporarily rendered unusable by Japanese bombardment; Japanese mass for attack on American beachhead.
- Oct. 23—Japanese launch major Guadalcanal counteroffensive.
- Oct. 25-26—Japanese Guadalcanal attacks fail.
- Oct. 26—Japanese are defeated in naval Battle of Santa Cruz.
- Oct. 29—Alaska Highway is open for traffic; Japanese break contact with United States forces on Guadalcanal and withdraw northward.
- Nov. 1—Americans begin Guadalcanal offensive.
- Nov. 12—Series of naval engagements (Battle of Guadalcanal, ending Nov. 15) thwarts Japanese efforts to land reinforcements on Guadalcanal.
- Nov. 16—Australians and Americans, having forced Japanese back into Buna-Gona beachhead during past month, attack that position.
- Nov. 30—Japanese are thwarted in effort to reinforce Guadalcanal, but defeat United States cruiser task force (Battle of Tassafaronga).
- Dec. 1—Australians capture Gona.
- Dec. 16—British begin limited offensive in Arakan coastal area in Burma.
- Dec. 18—Allies begin major offensive against Japanese positions around Buna.
- 1943
- Jan. 2—Organized Japanese resistance at Buna ends.
- Jan. 22—Japanese positions around Sanananda, New Guinea, are overrun.
- Feb. 1—Japanese begin evacuation of Guadalcanal (operation is completed Feb. 7).
- Feb. 8—Brig. Orde C. Wingate's Chindits begin three-month raid against Mandalay-Myitkyina railroad.
- Feb. 9—Organized Japanese resistance ends on Guadalcanal.
- Feb. 21—Americans land on Russell Islands.
- March 2—Battle of the Bismarck Sea begins (ends March 4 with destruction of entire Japanese convoy).
- March 12—Japanese defeat British on Arakan front.
- March 26—United States naval task force turns back effort by Japanese to reinforce their Aleutian garrisons.
- April 18—Adm. Isoroku Yamamoto is killed when a Japanese plane is shot down over Solomon Islands.
- May 11—American expeditionary force lands on Attu.
- May 12—British withdraw to original positions in Arakan sector of Burma.
- May 30—Japanese resistance collapses on Attu.
- June 30—Operation Cartwheel begins with Allied landings in central Solomon Islands, Trobriand Islands, and Nassau Bay area of New Guinea.
- July 5—United States naval forces partially block Japanese attempt to reinforce Kolombangara Island, central Solomons (Battle of Kula Gulf).
- July 12—United States naval task force fails to prevent Japanese reinforcements from reaching Kolombangara (Battle of Kolombangara or Second Battle of Kula Gulf).
- July 28—Japanese evacuate Kiska undetected by Allies.
- Aug. 5—After 12 days of heavy fighting, Americans capture Munda Airfield, New Georgia, central Solomons.
- Aug. 6—Japanese naval force is defeated off Kolombangara (Battle of Vella Gulf).
- Aug. 15—Allied force begins landing on Kiska (by Aug. 22, concedes island is deserted).
- Oct. 2—Japanese withdraw successfully from Kolombangara; Australians capture Finschhafen, New Guinea.
- Oct. 6-7—Japanese destroyers fight off smaller force of American destroyers while evacuating Japanese troops from Vella Lavella (Battle of Vella Lavella).
- Oct. 12—United States Army Air Forces begin heavy air attacks on Rabaul, New Britain.
- Nov. 1—Americans land on Bougainville Island, northern Solomons; during following night, Japanese naval task force is defeated offshore (Battle of Empress Augusta Bay).
- Nov. 21—Americans begin landing on Makin and Tarawa,

Gilbert Islands (atolls are cleared in three days).  
 Nov. 25—Japanese destroyers are defeated off New Ireland (Battle of Cape St. George).  
 Dec. 24—Bougainville beachhead, containing new airfields, is secured.  
 Dec. 26—Americans land at Cape Gloucester, New Britain.  
 Dec. 29–30—Cape Gloucester airfields are secured.  
 1944  
 Jan. 25—Chinese troops under General Stilwell begin counteroffensive in Burma.  
 Feb. 1—Americans land on Kwajalein, Marshall Islands (atoll is cleared by Feb. 8).  
 Feb. 18—United States naval task forces complete neutralization of Japanese base at Truk; Americans begin landing on Eniwetok, Marshall Islands (atoll is secured by Feb. 23).  
 Feb. 24—United States 5307th Composite Unit (Merrill's Marauders) begins raid aimed at Myitkyina airfield.  
 Feb. 29—Americans land on Los Negros Island, Admiralty Islands.  
 March 8—Japanese attack perimeter around Bougainville airfields; launch drive from Burma on Imphal and Kohima, India.  
 March 24—Organized Japanese resistance is broken on Bougainville and Los Negros.  
 March 31—Japanese surround Imphal.  
 April 8—Japanese surround Kohima.  
 April 17—Japanese launch offensive in Honan, China, directed at United States B-29 bases.  
 April 22—Allied forces land in Hollandia area of New Guinea.  
 May 17—Allied operations are commenced against Wakde Islands off Netherlands New Guinea coast; Marauders capture Myitkyina airfield.  
 May 24—Japanese begin counterattack at Myitkyina.  
 May 27—In New Guinea area, Allied forces land on Biak Island.  
 June 5—Japanese are defeated in Imphal-Kohima area.  
 June 15—United States Marines invade Saipan, Mariana Islands.  
 June 19—Japanese Fleet is badly defeated by United States carrier aviation in Battle of the Philippine Sea ("Marianas Turkey Shoot"; battle ends June 20).  
 June 22—Japanese begin retreat from Kohima-Imphal area.  
 July 9—Saipan is secured.  
 July 21—Americans land on Guam.  
 July 24—Americans land on Tinian, Mariana Islands.  
 July 28—Organized Japanese resistance ends on Biak.  
 July 30—Americans land on Vogelkop Peninsula, New Guinea.  
 Aug. 1—Tinian is secured.  
 Aug. 3—Myitkyina, Burma, is captured.  
 Aug. 10—Organized Japanese resistance is destroyed on Guam.  
 Aug. 20—Biak is secured.  
 Aug. 29—Japanese continue successful offensive against American Honan air bases.  
 Sept. 15—Americans land on Morotai Island and Palau Islands.  
 Sept. 17—Morotai is secured.  
 Oct. 10—United States Third Fleet carrier task force raids Okinawa.  
 Oct. 13—United States Third Fleet begins raids on Taiwan.  
 Oct. 15—Allies begin offensive to clear northern Burma.  
 Oct. 17—United States Ranger units occupy small islands at entrance to Leyte Gulf.  
 Oct. 18—General Stilwell is relieved.  
 Oct. 20—United States Sixth Army invades Leyte.  
 Oct. 21—Palau Islands are secured.  
 Oct. 23—Battle for Leyte Gulf begins between United States and Japanese fleets (ends Oct. 26 with Japanese defeat).  
 Nov. 24—B-29's make first raid on Tokyo from bases in Mariana Islands.  
 Dec. 10—Japanese forces in southern China link up with Japanese forces in French Indochina.  
 Dec. 12—British launch offensive in Arakan sector of Burma.  
 Dec. 15—Americans invade Mindoro, Philippines.  
 1945  
 Jan. 1—Major offensive operations are completed on Leyte (mopping up continues until May 8).  
 Jan. 2—United States convoys begin moving toward Luzon, Philippines.  
 Jan. 3—British Arakan offensive recaptures Akyab.  
 Jan. 9—United States Sixth Army begins landing at Lingayen Gulf, Luzon.  
 Jan. 20—Converging attacks from China and Burma reopen Burma Road.  
 Feb. 3—United States 1st Cavalry Division enters Manila.  
 Feb. 16—Americans launch airborne-amphibious assault on Corregidor Island, Manila Bay (completed March

2); heavy preparatory naval-air bombardment of Iwo Jima. Volcano Islands, begins.  
 Feb. 19—United States Marines land on Iwo Jima.  
 Feb. 25—United States 21st Bomber Command makes first mass incendiary-bomb raid on Tokyo.  
 March 3—Last Japanese position in Manila is wiped out.  
 March 10—Americans land on Mindanao, Philippines.  
 March 16—Iwo Jima is declared secure.  
 March 18–19—United States carrier aircraft attack Japanese air and naval bases in preparation for coming invasion of Okinawa.  
 March 21—British complete recapture of Mandalay, Burma.  
 March 26—Americans land on Kerama-retto near Okinawa (islands are completely occupied March 28).  
 April 1—United States Tenth Army lands on Okinawa.  
 April 7—Japanese naval sortie toward Okinawa is routed (Battle of the East China Sea).  
 April 11—Japanese begin furious air offensive, using Kamikaze aircraft, against United States shipping off Okinawa.  
 May 3—British reoccupy Rangoon.  
 May 11—Chinese forces halt Japanese drive on Chihkiang (begun April 1944).  
 May 20—Japanese in China begin moving troops northward to reinforce their army in Manchuria.  
 June 21—Organized Japanese resistance on Okinawa ends.  
 June 30—Luzon is declared secure (mopping up continues until end of war).  
 July 1—Australians and Dutch begin operations in Balikpapan area of Borneo.  
 July 10—United States Navy and Army aircraft begin a major offensive against Japan in preparation for planned invasion.  
 July 16—United States tests successful atomic bomb at Alamogordo, N.Mex.  
 July 17—British Pacific Fleet joins United States Third Fleet in attacks on Japan.  
 Aug. 6—Atomic bomb is dropped on Hiroshima.  
 Aug. 8—The USSR declares war on Japan (effective Aug. 9).  
 Aug. 9—Atomic bomb is dropped on Nagasaki; Russians invade Manchuria.  
 Aug. 12—Soviet troops enter northern Korea.  
 Aug. 14—Japan surrenders.

#### POLITICAL AND DIPLOMATIC DEVELOPMENTS OF THE WAR AND POSTWAR PERIODS

##### 1939

Sept. 3—Great Britain and France declare war on Germany.  
 Sept. 28—Germany and the USSR revise nonaggression pact.

##### 1940

March 12—Finland capitulates, signing Treaty of Moscow.  
 May 10—Winston Churchill becomes prime minister of Great Britain.  
 June 10—Italy declares war on France and Great Britain (effective June 11).  
 June 15—The USSR begins seizure of Lithuania, Latvia and Estonia (ends Aug. 6).  
 June 22—German-French armistice is signed (fighting ends June 25 after signature of Italo-French armistice June 24).  
 June 28—USSR seizes Bessarabia and northern Bucovina.  
 July 25—United States begins embargo on shipment of strategic materials to Japan.  
 Sept. 3—United States trades 50 destroyers for naval base sites in British possessions.  
 Sept. 16—President Roosevelt signs first American peacetime Selective Service Act.  
 Sept. 22—Japanese begin occupation of northern French Indochina.  
 Sept. 26—United States imposes total embargo on scrap shipments to Japan.  
 Sept. 27—Japan joins Axis (Tripartite Pact).  
 Nov. 20—Hungary joins Axis.  
 Nov. 22—Rumania joins Axis.

##### 1941

March 1—Bulgaria joins Axis.  
 March 11—Congress passes Lend-Lease Act.  
 March 25—Yugoslavia joins Axis.  
 March 26–27—Anti-Axis coup d'état takes place in Yugoslavia.  
 April 13—Japan and the USSR sign neutrality pact.  
 May 27—Roosevelt proclaims unlimited national emergency.  
 June 14—German and Italian assets in the United States are frozen.  
 June 22—Germany, Italy, and Rumania declare war on the USSR.  
 June 26—Finland declares war on the USSR.  
 June 27—Hungary declares war on the USSR.  
 July 23—Japan occupies southern Indochina.  
 July 25—Japanese assets in the United States are frozen.  
 Aug. 14—Roosevelt and Churchill issue Atlantic Charter.

Sept. 17—British and Soviet troops occupy Teheran, Iran.  
 Dec. 8—Japan declares war on the United States and Great Britain; the United States and Great Britain declare war on Japan.  
 Dec. 9—China declares war on Japan, Germany, and Italy.  
 Dec. 11—Germany and Italy declare war on the United States, which then declares war on them.  
 Dec. 24—British-American Arcadia conferences open in Washington (end Jan. 14, 1942).  
 1942  
 Jan. 1—Declaration by United Nations is signed by 26 countries.  
 April 8—Bolo Conference begins in London (ends April 14).  
 Oct. 22—To clear way for Operation Torch (Allied invasion of French North Africa), Maj. Gen. Mark W. Clark lands from submarine for secret meeting with pro-Allied French officers.  
 Dec. 24—Admiral Darlan is assassinated.  
 1943  
 Jan. 14—British-United States conference opens at Casablanca (ends Jan. 24).  
 May 12—Trident Conference opens in Washington (ends May 25).  
 July 25—King Victor Emmanuel III of Italy proclaims fall of Mussolini, replacing him with Marshal Pietro Badoglio.  
 Aug. 14—Quadrant Conference opens in Quebec, Canada (ends Aug. 24).  
 Sept. 3—Italian government signs armistice (effective Sept. 8).  
 Oct. 13—Italy declares war on Germany.  
 Nov. 22—Sextant Conference opens at Cairo, Egypt (recesses Nov. 26).  
 Nov. 28—Eureka Conference opens at Teheran, Iran (closes Dec. 1).  
 Dec. 1—Cairo Declaration is issued.  
 Dec. 3—Sextant Conference reopens at Cairo (closes Dec. 7).  
 1944  
 July 20—Attempt to assassinate Hitler fails.  
 Aug. 21—Dumbarton Oaks Conference opens (ends Oct. 7).  
 Aug. 23—Rumania surrenders unconditionally.  
 Aug. 25—Rumania declares war on Germany.  
 Aug. 26—Bulgaria opens negotiations for surrender with Allies.  
 Sept. 5—The USSR declares war on Bulgaria.  
 Sept. 8—Bulgaria declares war on Germany.  
 Sept. 9—The USSR grants Bulgaria an armistice.  
 Sept. 12—Rumania signs armistice; Octagon Conference opens in Quebec (ends Sept. 16).  
 Sept. 19—Allied-Finnish armistice is signed.  
 Oct. 23—Great Britain, the USSR, and the United States grant *de jure* recognition to French provisional government headed by Gen. Charles de Gaulle.  
 1945  
 Jan. 30—Preliminary Anglo-American phase (Cricket) of Argonaut Conference begins at Malta (ends Feb. 2).  
 Feb. 4—Second phase (Magnet) of Argonaut Conference opens at Yalta (ends Feb. 11).  
 March 3—Finland declares war on Germany.  
 March 10—Japanese place French Indochina under direct military administration.  
 April 5—The USSR notifies Japan that it intends to denounce their 1941 neutrality pact.  
 April 12—President Roosevelt dies.  
 April 23—Heinrich Himmler's offer to surrender German forces to Western Allies is rejected.  
 April 25—San Francisco Conference opens (adopts United Nations Charter June 26).  
 April 28—Mussolini is captured and killed by Italian partisans.  
 April 30—Hitler commits suicide.  
 May 7—German High Command surrenders all forces unconditionally at Reims.  
 July 17—Terminal Conference begins at Potsdam, Germany (ends Aug. 2).  
 July 26—Terminal Conference issues Potsdam Declaration, presenting surrender ultimatum to Japan.  
 July 28—Japanese announce that they will reject surrender ultimatum (rejected July 30).  
 Aug. 8—The USSR declares war on Japan (effective Aug. 9).  
 Aug. 10—Japan offers to surrender.  
 Aug. 14—Japan surrenders.  
 Sept. 2—Japanese representatives sign instrument of surrender aboard the battleship *Missouri* in Tokyo Bay.  
 Sept. 11—Big Four foreign ministers' meeting opens in London (ends Oct. 2).  
 Dec. 16—Foreign ministers' meeting opens in Moscow (ends Dec. 26).  
 1946  
 April 25—Foreign ministers' meeting opens in Paris (ends May 1)

June 15—Foreign ministers' meeting reconvenes in Paris, reaching substantial agreement on treaties for Italy, Bulgaria, Rumania, Hungary, and Finland (ends July 12).  
 July 16—Peace conference opens in Paris (ends Oct. 15).  
 Nov. 4—Foreign ministers meet in New York to complete treaties (meeting ends Dec. 12).

1947

Feb. 10—Italian, Bulgarian, Rumanian, Hungarian, and Finnish peace treaties are signed in Paris.  
 Sept. 15—Five peace treaties come into force.

1950

June 25—Korean War begins.

1951

Sept. 4—Conference meets in San Francisco to draw up Japanese Peace Treaty.

1952

April 28—Japanese Peace Treaty comes into force.

1953

July 27—Armistice ends Korean War.

1954

Oct. 5—Free Territory of Trieste is divided between Italy and Yugoslavia.

1955

May 15—Austrian State Treaty is signed in Vienna.

July 27—Austrian treaty comes into force.

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### 17. Costs, Casualties, and Other Data

World War II spread death and devastation throughout most of the world to an extent never before experienced. The loss of life can be only generally summarized; an attempt to express the value of property and livelihoods destroyed in terms of money is futile; the resulting sums reach astronomical figures that have little if any practical meaning.

**Military Casualties.**—Probably the best documented and most meaningful figures are the battle casualties. Those for the United States, Great Britain, and the Commonwealth nations are accurate; those for other nations, Allied or Axis, vary in reliability. Chinese figures are largely estimates because of the lack of documentation, information on Soviet losses has been given only grudgingly and in very general terms, and many records of the Axis nations were lost when those countries were overrun. The most accurate available figures are shown in Tables 1, 2, and 3.

Table 1—UNITED STATES ARMED FORCES TOTAL STRENGTH AND CASUALTIES IN WORLD WAR II, DEC. 7, 1941—DEC. 31, 1946

Service	Total strength	Battle deaths	Deaths from other causes	Wounds	Captured or missing
Army <sup>2</sup>	11,260,000	234,874	83,400	565,861	135,524
Navy	4,183,466	36,950	25,664	37,778	2,429
Marine Corps	669,100	19,733	4,778	67,207	1,756
Coast Guard	241,093	574	1,345	955	
Total	16,353,659	292,131	115,187	671,801	139,709

<sup>1</sup> Not mortal. <sup>2</sup> Includes Army Air Forces.

In utilizing strength figures, it should be noted that total strength means the total number of personnel belonging to the armed forces during the entire war, whereas peak strength is the greatest strength reached at any one time during the war. Several methods of classifying and computing casualties are in use, and other variations result from the differing periods covered by the various computations. Consequently, different reputable reference works sometimes show slightly different figures even for United States casualties. Non-battle deaths include deaths from accidents and disease.



Table 2—ARMED FORCES PEAK STRENGTHS AND BATTLE DEATHS OF THE PRINCIPAL ALLIED POWERS

Nation	Peak strength	Battle deaths
Australia	680,000	23,365
Belgium	650,000	7,760
Canada	780,000	37,476
China	5,000,000	2,200,000 <sup>1</sup>
Denmark	25,000	3,006 <sup>2</sup>
France	5,000,000	210,671
Greece	414,000	73,700 <sup>2</sup>
India	2,150,000	24,338
Netherlands	410,000	6,238
New Zealand	157,000	10,033
Norway	45,000	1,000
Poland	1,000,000	320,000
USSR	12,500,000	7,500,000
Union of South Africa	140,000	6,840
United Kingdom	5,120,000	244,723
United States	12,300,000	292,131
Yugoslavia	500,000	410,000 <sup>2</sup>

<sup>1</sup> Casualties beginning with the Japanese invasion in 1937. <sup>2</sup> Most of these casualties were suffered in guerrilla warfare that followed German occupation of the country. In the case of Denmark they include more than 1,200 merchant sailors in the service of the Allied powers.

Table 3—ARMED FORCES PEAK STRENGTHS AND BATTLE DEATHS OF THE AXIS POWERS

Nation	Peak strength	Battle deaths
Bulgaria	450,000	10,000 <sup>1</sup>
Finland	250,000	82,000
Germany	10,200,000	3,500,000
Hungary	350,000	140,000
Italy	3,750,000	77,494 <sup>2</sup>
Japan	6,095,000	1,219,000
Rumania	600,000	300,000 <sup>1</sup>

<sup>1</sup> A limited number of these casualties occurred after the country joined the Allies. <sup>2</sup> Of these, 17,494 were killed after Italy became a cobelligerent with the Allies.

**Civilian Casualties.**—Casualties among civilians were much less accurately recorded than military losses. In part, this was unavoidable because of the population shifts that took place as civilians fled before invading armies or the continual air attacks on major industrial centers, or were sent to Germany or the Soviet Union for forced labor.

Civilian casualties in the United Kingdom, slightly over half of which were inflicted in the London area, were as follows:

Agent	Killed	Seriously injured	Total
Aircraft bombs	51,509	61,423	112,932
V-1 (flying bombs)	6,184	17,981	24,165
V-2	2,754	6,523	9,277
Artillery fire	148	255	403
Total	60,595	86,182	146,777

Civilian casualties in the USSR have been placed roughly at 2,500,000 killed. The loss of population (including both military and civilian casualties) caused directly or indirectly by the war has been stated at 20,000,000. Air raids against Germany killed approximately 300,000 Germans and seriously injured about 780,000 more. Numerous additional casualties occurred during the Soviet invasion of 1944-1945, but no specific estimates are available. Japanese civilian casualties probably approached 500,000 killed and 625,000 seriously injured, plus a considerable number reported as missing after the fire raids and atomic bombings. In addition, about 360,000 Japanese captured by the Russians in Manchuria, Korea, and the Kuril Islands were still missing in 1950; a large number of them have never been accounted for. Chinese civilian losses are unknown but probably numbered several million.

**Industrial Conversion and War Production.**—In the final analysis, victory was won by the Allied powers' technological superiority—the ability to raise, arm, equip, move, and supply superior forces throughout the world, and through them to break up and destroy the technological resources (as well as much of the armed forces) of the Axis nations. Of all the Allies, it was the United States that possessed the raw materials, skilled manpower, and industries that made their victory possible. This potential American technological power, however, required precious time to change from peacetime to military production. The process of conversion, and of reconversion at the war's end, is illustrated in Table 4.

Table 4—UNITED STATES BUDGET EXPENDITURES, JULY 1, 1940–AUG. 31, 1945 (Billions of dollars)

Expenditures	1940	1941	1942	1943	1944	1945
Defense expenditures:						
War Department	\$0.9	\$ 7.3	\$29.5	\$46.5	\$49.2	\$34.0
Navy Department	0.9	4.2	14.0	24.6	29.6	19.4
Other departments	0.1	2.7	8.9	14.1	12.1	6.4
Total	1.9	14.2	52.4	85.2	90.9	59.8
Nondefense expenditures:						
Total	3.4	6.0	5.4	5.0	6.3	6.2
Total	\$5.3	\$20.2	\$57.8	\$90.2	\$97.2	\$66.0

Among the varied items purchased by United States defense expenditures were 57,027 medium tanks (9 different types), 676,433 two-and-one-half-ton, six-wheel-drive trucks (11 types), 1,054 eight-inch howitzers (48 of them self-propelled), 476,628 2.36-inch rocket launchers (bazookas), 4,014,731 Garand rifles, 106,658 gunner's quadrants, 407,200,000 rounds of .45-caliber ammunition, 57,488,000 wool undershirts, 116,000,000 pounds of peanut butter, 206,753 SCR-536 (Handie-Talkie) radio sets, 500,754 30-dose bottles of influenza virus vaccine, 7,570 locomotives (48 types), 23,510,030 military gas masks (2 types), and 3,898 B-29 (Superfortress) very heavy bombers. One of the best indications of the growing tempo of American military production during the war is the following data on machine-gun production, covering the period July 1, 1940–Aug. 31, 1945:

Year	.50 Caliber <sup>1</sup>	.30 Caliber	Year	.50 Caliber	.30 Caliber
1940	5,135	3,633	1943	641,638	188,311
1941	49,479	27,672	1944	677,011	121,771
1942	347,492	314,839	1945	239,821	62,977

<sup>1</sup> The increasing preponderance of .50-caliber machine guns reflects their growing use as aircraft and armored vehicle armament.

**Shipping Losses.**—Allied merchant shipping losses during the war were as follows:

Year	Number of vessels	Tonnage
1939	221	755,237
1940	1,059	3,991,641
1941	1,299	4,328,558
1942	1,664	7,790,697
1943	597	3,220,137
1944	205	1,045,629
1945	105	438,821
Total	5,150	21,570,720

Of the 5,150 Allied merchant vessels sunk, 2,828 were victims of Axis submarines, principally German. The parallel German submarine losses (revised according to the latest British Admiralty assessment) therefore furnish an interesting in-

dication of the gradual Allied success in antisubmarine warfare:

Year	Loss	Year	Loss
1939	9	1943	237
1940	24	1944	242
1941	35	1945	151
1942	87	Total	785

Other German naval losses included 2 battleships, 2 battle cruisers, 3 pocket battleships, 2 old battleships, 2 heavy cruisers, 5 light cruisers, 44 destroyers, and 86 light warships and armed merchant raiders, as well as 1,377 minor and auxiliary warships and approximately 550 landing craft. Japanese naval battle losses included 10 battleships, 20 carriers, 38 cruisers, 115 destroyers, and 119 submarines. The rapid disappearance of the Japanese merchant marine is shown in the tonnage available: 6.1 million tons in 1941, but 1.8 million tons in 1945.

British Commonwealth naval losses from Sept. 3, 1939, to Aug. 15, 1945, including Allied warships operating under British control, comprised 4 battleships, 2 battle cruisers, 5 aircraft carriers, 5 auxiliary aircraft carriers, 33 cruisers, 154 destroyers, 90 submarines, and 138 light warships and armed merchant cruisers, as well as 1,307 auxiliary and minor warships and 1,326 landing ships and craft of all types. U.S. naval losses and gains during the war were as follows:

Type of vessel	Losses	New ships <sup>1</sup>
Battleships	2	8
Aircraft carriers	5	27
Escort aircraft carriers	6	110
Cruisers	10	48
Destroyers	71	349
Submarines	52	203

<sup>1</sup>Part of this new construction, particularly escort aircraft carriers, was transferred to Great Britain as lend-lease material.

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WORLD WAR II WAR CRIMES TRIALS. See WAR CRIMES.

**WORLD WEATHER WATCH**, a program developed in the early 1960's by the World Meteorological Organization (WMO) to improve the worldwide system of meteorological observations and forecasting. The goal of the World Weather Watch (WWW), which became operational in 1968, was to establish an efficient network of communications that avoided duplication in preparing meteorological analyses and prognoses, while providing weather services throughout the world with relevant data and background information on a daily basis. The WWW is made up of research centers and satellites in a coordinated worldwide network that constantly monitors the world weather situation.

**WORLD ZIONIST ORGANIZATION**, originally called the Zionist Organization, founded in 1897 by Theodor Herzl for the purpose of achieving the goals of Zionism. The WZO defined itself as "comprising all Jews who accept the Zionist program" as drafted by the First Zionist Congress in Basel, Switzerland. "Zionism," it stated, "strives to create for the Jewish people a home in Palestine secured by public law."

Within a year after the First Zionist Congress, local organizations were established in major European countries as well as in the United States and Argentina. At the Second Zionist Congress (Basel, 1898), 913 local groups were represented by 349 delegates. The congress was empowered to function as the supreme forum and legislative body of the WZO.

In the course of time, ideas concerning the precise form the Jewish commonwealth was to take in Palestine evolved from a rather vague "national home" into a demand for a Jewish state, as foreshadowed by Herzl in his book *The Jewish State* (1896). Early advocates of the Jewish state idea were the Zionist-Revisionists led by Vladimir Jabotinsky.

The work of the WZO was given impetus by the issuance of the Balfour Declaration on Nov. 2, 1917. A few weeks later (Jan. 5, 1918) the German government issued a similar pronouncement, welcoming a statement by the Turkish grand vizier Talat Pasa in support of a "flourishing Jewish settlement" in Palestine. With that, the WZO became a factor on the international political scene.

In 1929 the 16th Zionist Congress approved the establishment of an expanded Jewish Agency to enable non-Zionists to participate equally with members of the WZO in the building of a Jewish national home without identifying themselves with the political aspirations of Zionism.

The 23d Zionist Congress (1951), the first to meet after the establishment of the State of Israel, replaced the outdated Basel Program of 1897 with the Jerusalem Program. The new text declared: "The task of Zionism is to strengthen the State of Israel, to gather the exiles in the Land of Israel, and to guarantee the unity of the Jewish people."

In 1968 the 27th Zionist Congress redefined the aims of Zionism as "the unity of the Jewish people and the centrality of Israel in its life; the ingathering of the Jewish people in its historic homeland, Eretz Israel, through *aliya* [immigration] from all lands; the strengthening of the State of Israel founded on the prophetic ideals of



HISTORICAL PICTURE SERVICE

Much of the Columbian Exposition's simulated marble city, like its Court of Honor, fronted on artificial lagoons.

justice and peace; the preservation of the identity of the Jewish people through the fostering of Jewish and Hebrew education, and of Jewish spiritual and cultural values; the protection of Jewish rights everywhere."

In 1969 the Zionist General Council, the executive arm of the WZO, resolved to reconstitute the Jewish Agency for Israel by enlarging it so as to include representatives of Jewish communities worldwide. It was decided that of the delegates to the Assembly of the Jewish Agency, 50% should represent the WZO (including Israel), 30% the Jews of the United States, and 20% those of the rest of the world. An agreement was reached on the division of functions. Accordingly, the Jewish Agency was to conduct the activities supported by Jewish philanthropies throughout the world, such as absorption of immigrants and social, health, and educational programs, while the WZO would be responsible for public information, publications, education in the diaspora, and support of cultural institutions. The international headquarters are in Jerusalem.

See also ZIONISM.

RAPHAEL PATAI, *Editor of*  
*"Encyclopedia of Zionism and Israel"*

**WORLD'S COLUMBIAN EXPOSITION OF 1893**, an international exhibition held in Chicago, Ill., to commemorate the 400th anniversary of the discovery of America by Christopher Columbus. The exhibition was sometimes called the Chicago World's Fair. Authorized by Congress in 1890, the fair was dedicated on Oct. 12, 1892, by the vice president of the United States, and formally opened, after construction was completed, on May 1, 1893. With the push of a switch, President Grover Cleveland activated the electric power for the fair, turning on the incandescent lights and starting the electric fountains. Elec-

tricity, then unfamiliar to most Americans, was one of the fair's chief wonders. The fair closed on Oct. 30, 1893.

The fair was situated in Jackson Park on Chicago's southern lakefront, partly converted from swampland by landscape architect Frederick Law Olmsted. It extended about 2 miles (3.2 km) along the shore of Lake Michigan. Under the direction of Daniel H. Burnham, about 150 buildings, designed by such leading architects as George McKim and Richard Morris Hunt, were built around artificial lagoons. After some debate, the architects settled on a generally classical overall style, though Louis Sullivan and others had wanted to promote more modern, native architectural styles. Many of the building facades were constructed from material called staff, a composition of plaster of paris and jute fibers that resembled marble and lent the exposition its popular nickname, the White City. Especially noteworthy among the buildings was Sullivan's Transportation Building. The Fine Arts Building was later rebuilt in limestone to house Chicago's Museum of Science and Industry. Inside the buildings were mounted elaborate exhibits of industry, the arts, the states, and many foreign nations. The Midway Plaisance, an area devoted principally to amusement features such as George W. G. Ferris' newly invented Ferris wheel, drew much attention.

The exposition proved a success; the average daily attendance was 172,712, with a total attendance of over 27 million. Many worldwide organizations held congresses on the grounds. Fair expenditures were covered by the city of Chicago, a special minting of souvenir half-dollars as the gift of Congress, and by admission fees. Profits amounted to about \$1.85 million.

**WORLD'S FAIRS.** See FAIRS AND EXPOSITIONS.

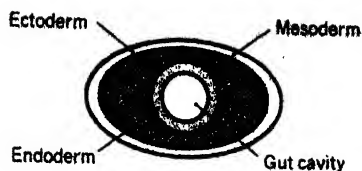
**NORM**, a general term for many unrelated animals with soft, slender, elongated bodies lacking backbones, including some that have simple appendages for locomotion. The term refers to animals that retain a wormlike shape throughout life as well as the larvae (immature stages) of many insects, such as the maggots of flies and the caterpillars of moths. Worms range from less than 1.02 inches (0.5 mm) for some mesozoans to more than 10 feet (3 meters) long for giant earthworms. Most worms are benthic (bottom dwellers); a few are parasitic (living in or on other organisms).

Most of the approximately 30 major divisions or phyla of the animal kingdom have at least some wormlike representatives. The four major phyla of worms are Platyhelminthes (flatworms, such as flukes and tapeworms), Nematoda (roundworms, such as hookworms), Nemertea or Nemertinea (ribbon or proboscis worms), and Annelida (segmented worms, such as earthworms and leeches). Minor phyla that are believed to be related to the Nematoda include Gastrotricha, Rotifera (wheel animalcules), Nematomorpha (gordian or horsehair worms), Kinorhyncha, and Acanthocephala (spiny-headed worms). Relatives of the Annelida include members of the phyla Sipuncula (peanut worms) and Echiura (spoon or innkeeper worms). Groups whose affinity is still uncertain are Gnathostomulida (jaw worms), Entoprocta, Phoronida, Priapulida, Ectoprocta (bryozoans or moss animals), Brachiopoda (lamp shells), Chaetognatha (arrow worms), Pentastomida (tongue worms), Tardigrada (water bears), Hemichordata (acorn worms), Pogonophora (beard worms), and Mesozoa. Determining the "nearest relatives" of these groups continues to challenge biologists. These kinships are particularly significant in the case of the Mesozoa because some biologists regard these minute highly specialized organisms as representing an intermediate stage between single-celled and multicellular animals, while other biologists consider them as degenerate descendants of flatworms.

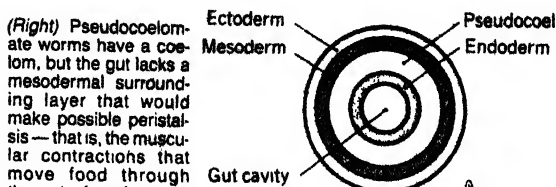
Worms are bilaterally symmetrical: their bodies can be divided into definite right and left sides that are mirror images of each other. In contrast, animals with radial symmetry, such as jellyfishes, have no definite right or left sides.

Bilaterally symmetrical animals develop in one of two ways. The fertilized egg divides repeatedly and forms a cluster of several hundred to perhaps a thousand cells. An opening, the blastopore, appears on the surface of the cluster. If the blastopore ultimately becomes the mouth of the adult animal, that animal is called a protostome (*proto*, "first"; *stoma*, "mouth"); if the blastopore becomes the anus, the animal is a deuterostome (*deutero*, "second"; *stoma*, "mouth"). All worm phyla are protostomes except the Hemichordata and the Chaetognatha, which are deuterostomes. Two other events during development—the formation of the body cavity (or its absence), and the tissues that line it—enable biologists to subdivide protostomes still further.

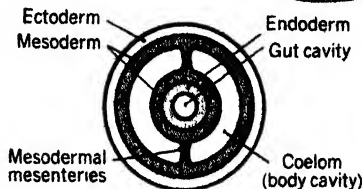
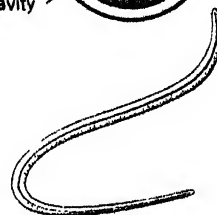
After the blastopore forms, cells arrange themselves into three groups or germ layers—ectoderm, endoderm, mesoderm—or fabric from which the adult animal forms. Mesoderm gives rise to many internal organs, all muscles, and the lining of the body cavity. A true body cavity, or coelom, is the space between the gut and the body wall, and it is completely lined with tissue



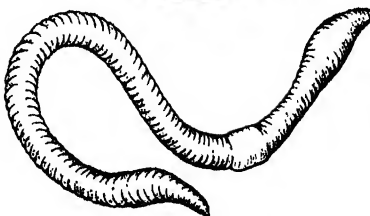
(Left) The acoelomate worms, such as the flatworm *Dugesia* of the class Turbellaria — shown in cross section and in full — are so named because they have no body cavity (coelom) between the body wall and internal organs. The space is instead filled with cells that derive from the embryonic mesoderm.



(Right) Pseudocoelomate worms have a coelom, but the gut lacks a mesodermal surrounding layer that would make possible peristalsis—that is, the muscular contractions that move food through the gut of coelomates. Pseudocoelomates also lack mesenteries, the membranes that support the gut of coelomates. The roundworm *Ascaris* of the phylum Nematoda is illustrated here



(Left) Coelomate worms, along with all higher animal phyla, possess a true coelom. The gut-tube endoderm is surrounded by mesodermal tissue, which also lines the body's outer wall, and mesodermal mesenteries support a coelomate's internal organs. Seen in cross section and in full is *Lumbricus*, an earthworm of the class Oligochaeta of the phylum Annelida.



of mesodermal origin. In worms this cavity usually is filled with a fluid that functions as the skeleton. Annelids and their relatives have a true body cavity and are called coelomates. No body cavity develops in some protostomes (flatworms, ribbon worms, gnathostomulids). These animals are called acoelomates (*a*, "without"; *coelom*, "cavity"). A cavity does appear in roundworms and their relatives, but it is only partially lined with tissue derived from mesoderm. These animals are called pseudocoelomates (*pseudo*, "false"; *coelom*, "cavity"). The illustration shows the general organization of these three types of body structure.

The coelom itself develops in two ways. In one process, cells from the region of the blastopore divide and migrate inwardly; the resulting clumps of cells split and form the schizocoelom (*schizo*, "split"), which is typical of many coelomate protostomes, particularly the annelids and their relatives. In the other process, the blastopore invaginates (folds inward) and forms

the primitive gut; cells from the innermost end of the gut form the mesoderm that eventually encloses an enterocoelom (*entero*, "gut"). Deuterostomes tend to be enterocoelous.

Other characteristics must be used to classify coelomates, acoelomates, and pseudocoelomates still further. For example, flatworms and gnathostomulids are acoelomates that have an incomplete digestive tract—that is, the same opening (the mouth) takes in food and ejects waste. Gnathostomulids differ from flatworms in the molecular structure of their flagella, which are oarlike structures that assist in movement. The structure of the head, jaws, and bristlelike sensory apparatus of gnathostomulids closely resembles those of certain pseudocoelomates. Thus gnathostomulids have features of both acoelomates and pseudocoelomates.

Ribbon worms are acoelomates that have a complete digestive tract (separate mouth and anus), and an eversible proboscis that captures food and, when armed, protects the worm. In these worms, "eversible" means that the proboscis lies in its cavity like a finger of a glove that has been pulled to the inside of the glove. The proboscis is then shot out when food is nearby. The "armed" proboscis of some nemerteans has barbs (stylets) that can pierce would-be predators and potential victims.

Among marine annelids and their relatives, the presence of a particular larva, the trochophore, is often cited as evidence for kinship, but larval forms may be similar for other reasons. The early development of these animals is strikingly similar and is the major reason for considering them as related groups.

Three phyla of uncertain classification are Pogonophora, Tardigrada, and Pentastomida. When pogonophorans were discovered, they were believed to be deuterostomes. Now they are considered intermediate to protostomes and deuterostomes or even as a completely separate evolutionary line. The discovery of giant pogonophorans, made when the submersible *Alvin* descended to the Galapagos Rift, may provide zoologists with the information needed to determine the status of these worms. Tardigrades superficially resemble gastrotrichs, and may be pseudocoelomate. They fascinate biologists because they can survive near absolute zero (about  $-273^{\circ}\text{C}$  or  $-459^{\circ}\text{F}$ ). Pentastomids are probably related to the arthropods, in which case they should not be considered true worms.

More than a century ago, Charles Darwin showed how beneficial earthworms are to farmers in loosening and conditioning the soil. And several species of parasitic worms have long been recognized as causes of diseases in humans and in domesticated plants and animals. Worms have become increasingly important in basic research and medicine. For example, toxins from ribbon worms show promise as effective agents against certain cancers. The brain and nervous system of leeches are particularly well suited to studying how nerve cells function in groups. Rotifers have been used to study the aging process, and other pseudocoelomates are used in genetic research, both at the chromosomal level and to learn how a single nerve cell controls several different tissues.

See also ANNELIDA; NEMATODA; NEMERTINA; PLATYHELMINTHES.

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**WORM GEAR.** See GEAR.

**WORM LIZARD**, a cylindrically shaped reptile, usually limbless, adapted for life underground. The skull is specialized for digging, with closely sutured bones. The long body has 85 to 156 vertebrae, but is limbless except in the species of *Bipes* in Baja California, which has well-formed front legs. The tail and head are blunt, the latter sometimes having a wedge-shaped tip. The scales are small and arranged in narrow rings. By moving these rings the animal can travel forward or backward in its self-made tunnel, like an earthworm. The four families, usually placed in a separate suborder, the Amphisbaenia, include fossil members from Paleocene time and 140 living species. Numerous of these species occur in South America, the West Indies, western Asia, and Africa, but only one each in Spain and Florida. The only species native to the United States is *Rhineura floridana*, which lives in central and northern Florida. It feeds on termites, spiders, and earthworms, and seldom attains a length of 12 inches (30 cm). Other species may be an inch in diameter and up to 30 inches (75 cm) long.

TRACY I. STORER\*  
Coauthor of "General Zoology"

**WORM SNAKE**, a small, harmless, semiburrowing snake (*Carphophis amoenus*) of the deciduous forest region in the eastern and midwestern United States. Adults average about 9 inches (22 cm) long and are about  $\frac{1}{4}$  inch (0.6 cm) in diameter. The head is rounded in outline but wedge-shaped in side view, without a distinguishable neck. The short tail has a sharp tip. The smooth, glossy dorsal scales are in 13 rows. These snakes are brown with a pink belly in the East but black with bright red bellies west of the Mississippi River.

Worm snakes are among the most common snakes in many localities but are seldom seen because of their secretive habits. They are most active from late afternoon to midnight but usually are found only when exposed by turning over rocks or logs. They largely feed on earthworms. Two to five eggs are laid in June or July. These are surprisingly large for such small snakes, being almost 1 inch (2.5 cm) long and  $\frac{3}{4}$  inch (1.75 cm) in diameter. They usually hatch in September or early October, and the young are only about 4 inches (10 cm) long at birth.

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Coauthor of "General Zoology"

**WORMS**, vörms, a city in West Germany, in the state of Rhineland-Palatinate, on the left (west) bank of the Rhine River, 9 miles (14 km) north of Mannheim. The manufacture of machinery and leather products, sugar refining, canning, and iron and chemical industries are important economic activities. In addition, there is a good river port, and in the immediate area fine Rhine wines are produced. The most famous of these, Liebfraumilch, is named for a church (Liebfrauenkirche) on the northern edge of the city.

The Romanesque cathedral (1018–1234) has a choir at either end, each flanked by two tall round towers and surmounted by a lower one. Other points of interest are the Romanesque St. Paul's Church, the oldest parts of which date from 1016; St. Andrew's Church (11th–12th century); the late Romanesque Church of St. Maganus; and the late Gothic Liebfrauenkirche. The





FOTO MARBURG. FROM ART RESOURCE

Worms' double-apsed cathedral is one of the finest examples of German Romanesque architecture.

Jewish community is one of the oldest in Germany, dating from 588; original elements retained in the reconstructed synagogue are from the 12th and 13th centuries.

**History.** The original Celtic name of the place was Borbetomagus. In 14 B.C. the Romans established a fortification here among the Germanic Vangiones, who soon merged with the remaining Celts and the Romans. There were numerous invasions by Germanic tribes from across the Rhine, and toward the end of the Roman period the Emperor Honorius (reigned 395–423) established a Burgundian kingdom centered at Worms to act as a buffer state. The Burgundians became Arian Christians and probably used Ulfilas' Bible. Under Gundicar (Gunther of the *Nibelungenlied*) they revolted against the Romans, but the Roman general Flavius Aëtius with his Hun allies nearly wiped them out in 436.

By the 6th century the city was known as Wormatia, and in Carolingian times it was of considerable importance; Charlemagne held a number of diets here. Worms fought consistently to maintain its independence from the bishops and usually sided with the emperor, as it did with Henry IV (reigned 1056–1106) during the investiture struggle. The emperors rewarded the city with special privileges, so that Worms became in effect the first free city of the Holy Roman Empire, a status confirmed in 1273.

The most famous of the imperial diets held in Worms was that of 1521, before which Martin Luther appeared (see WORMS, DIET OF). The city was pillaged several times in the Thirty Years' War (1618–1648), but the worst destruction was caused by Louis XIV's general, Ezékiel de Mélac, who burned it in 1689. So complete was the destruction that the city council had to

remove to Frankfurt am Main and did not return for nine years. In 1797 the city became French, but in the general settlement of 1816 it was awarded to Hesse-Darmstadt (from 1866 known as Hesse).

During World War II, Worms suffered approximately 50% destruction, but after the war reconstruction proceeded rapidly, with an accompanying improvement even of some historic structures, such as the Church of St. Magnus. In the redivision of state territories in 1945, the city was included in the new State of Rhineland-Palatinate, which became a part of the Federal Republic of Germany (West Germany) in 1949. Population: (1984) 72,610.

A. G. STEER, JR.  
University of Georgia

**WORMS, Concordat of.** See CALLISTUS II; INVESTITURE CONTROVERSY.

**WORMS, Diet of (1521),** wôrms, an imperial diet (assembly) convoked by Charles V, newly elected Holy Roman emperor, in the city of Worms, Germany. It was the first of his reign. On the agenda, besides many political, military, and financial topics, was the case of Martin Luther. A clause in the emperor's contract with the German princes provided that, before confirming the sentence of a foreign court upon a German subject, he must give the accused a hearing. Luther had been excommunicated by Pope Leo X on Jan. 3, 1521, and Charles was urged by the Curia to impose the imperial ban upon him also. Luther's prince, Frederick III the Wise of Saxony, insisted upon a hearing.

Luther appeared before the assembled diet and on April 18, 1521, publicly refused to recant his views, unless "convicted by Scripture and plain reason"; "my conscience," he stated, "is captive to the Word of God." On May 25, just before the adjournment of the diet, Charles formally put the imperial ban on Luther by publishing the Edict of Worms, which he had signed on May 8. Thus Luther was outlawed, but the verdict was never executed.

WILHELM PAUCK, *Author of*  
"The Heritage of the Reformation"

**WORMWOOD,** wûrm'wôd, an aromatic herb (*Artemisia absinthium*) of the sunflower family, the source of oil of wormwood. It is a perennial, commonly 2 to 4 feet (0.6–1.2 m) tall, with clustered stems and silvery gray herbage. The leaf blades are up to about 4 inches (10 cm) long and are divided into numerous blunt or rounded small segments, the basal leaves being long stalked and larger than those of the stem. The numerous flower heads, which are scattered along branches that have reduced leaves, are small, yellowish, and individually rather inconspicuous, being hardly a quarter inch (0.6 cm) wide.

Oil of wormwood, a bitter, volatile, brownish green oil, is obtained by steam distillation from the dried leaves and tops. It is composed of a mixture of substances, including thujyl alcohol and acetate, thujone, phellandrene, and cadinene. It is used principally as the characteristic flavoring ingredient that distinguishes absinthe from all other alcoholic liquors. The deleterious effects of prolonged use of oil of wormwood have led to the outlawing of absinthe in some countries. Oil of wormwood was formerly used also as a tonic, appetizer, diuretic, anthelmintic (to expel or



Roche

Wormwood (*Artemisia absinthium*).

destroy intestinal worms, whence the name), antimalarial, moth repellent, and as an ingredient of liniment, but these uses have largely disappeared.

Wormwood is native to Eurasia and has been introduced into North America, where it occurs as a casual weed in waste places in the northern United States and southern Canada. It is grown commercially in limited quantities in Europe and also in the United States, as in Michigan, Wisconsin, and Oregon. The name wormwood is often applied also, by extension, to various other species of *Artemisia*, and even to some plants of superficially similar appearance but quite different properties and relationships, such as *Corydalis sempervirens*, called Roman wormwood.

ARTHUR CRONQUIST,  
Curator, The New York Botanical Garden.

**WORSHIP**, wŭr'shĭp, divine honors paid to God, specifically words addressed to Him, either said or sung, or acts performed in His honor. The term is derived from Anglo-Saxon *weorthscipe*, "worthship," the recognition or acknowledgment of worth or worthiness (compare Luke 14:10, Authorized Version, "Then shalt thou have worship," where Revised Standard Version reads "be honored"). In Judaism and Christianity, and in most other religions, divine worship is the highest expression of faith and devotion, and its chief component is prayer or praise.

The authentic pulsebeat of any religion is felt in its worship; to this all other elements, including its creed, theology, and organization, are secondary and dependent. In worship the sense of divine presence, and the attempt to approach God, to ascertain and yield to the divine will, are the central realities, hedged in mystery and filled with power. Sacraments, sacrifices, special offerings and dedications, festivals, supernatural cleansing and forgiveness, and the quest for divine power and grace—all these find their center action in worship. Thus in early Greece

and early Israel the festivals were essentially joyful celebrations (as at the harvest) of the divine presence and favor: God (or the god) was actually with his people, among them, spreading the blessings of his divine presence and goodwill. Such observances sometimes became little more than country fairs or secular feasts, but the religious significance was never wholly lost.

The early Christian church distinguished between the service of worship centered in "the Word" (the reading, study, and exposition of Holy Scripture) and that centered in the Sacrament (the Lord's Supper), where prayer and action were combined with reading. Both types had their antecedents in Judaism, the study of Scripture in the synagogue service, the sacramental or sacrificial rite in the worship of the Temple. Both types are reflected in modern Protestant and Roman Catholic worship: the Breviary Offices or "Hours," combined (for example, in Lutheran and Anglican worship) in the services of Morning and Evening Prayer, and the sacramental service of the Mass, Lord's Supper, or Holy Communion. The same is true of Orthodox Eastern worship, where the lectionary element (reading from Holy Scripture) is combined at great length with the central liturgical act of the Mass (the Holy Mysteries). Still other types of worship are found, not only in other religions but even in Christianity, where, for example, the Society of Friends (Quakers) have only the service of prayer and the reading of Scripture, and no sacraments.

The charge of "formality," sometimes brought against the classic types of Christian worship, could be brought against any kind of religion, even the most "inward" or inarticulate. On the other hand, objective or fully expressed worship is the normal means of access to the divine presence and the source of religious strength and inspiration to countless believers, from the simplest adherents to the most devout and consecrated saints.

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**WORSHIP, Freedom of**, the freedom to perform acts of worship or to conduct activities associated with religion without legal restraint. This article deals with the application of the principle in the United States. For the history of the subject in other countries, see CHURCH AND STATE; DECLARATION OF INDULGENCE; INQUISITION, THE; LIBERTY; TOLERATION; sections on religion in articles on individual countries; and separate articles on individual religions.

The beginnings of freedom of worship in America were highly ambiguous. Many of the early colonists left England to obtain this freedom, but they were generally unwilling to grant the same freedom to those whose patterns of worship differed from their own. The change came only gradually; even after the Revolution some particular Protestant church had special privileges in many of the states, and Roman Catholics and Jews were widely subject to legal disabilities. Since 1800, however, the growth of freedom of worship has been spectacular, both in its legal protection and in community practice. This development has disproved the assertion often made that freedom of worship thrives only where worship is considered unimportant: in the United

States the extension of religious freedom has been accompanied during both 19th and 20th centuries by the growth of a strikingly varied and vigorous religious pluralism.

**Constitutional Basis.**—In the original Constitution of the United States, the only clause relating to religion was that of Article VI forbidding religious tests for any office "under the United States." In the Bill of Rights, however, the 1st Amendment added this prohibition: "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof." This provision originally had no effect on establishments and restraints in force in the states, except to protect them from congressional interference. In recent decades, however, it has become settled that freedom of worship is part of the "liberty" protected against state action by the "due process" clause of the 14th Amendment. It has also been decided that the 1st Amendment provisions in their entirety have thus been made applicable to the states. Historians disagree, however, concerning the original understanding, both of the "no establishment" clause and of the "due process" clause in relation to religious freedom.

The "free exercise" and "no establishment" clauses are closely related; many measures which violate one necessarily violate the other also. For example, when the Supreme Court of the United States in 1961 struck down a Maryland state constitutional provision that officeholders must declare belief in the existence of God, the court considered that the requirement operated to "establish" theistic religion and also that it restrained the freedom of adherents of nontheistic religions such as Buddhism, of movements such as Ethical Culture, or of beliefs such as secular humanism.

Attempts are often made to express the effect of the two clauses in a single general principle. Perhaps most frequently urged is the principle of separation of church and state, requiring the insulation of religion from all exercise of state power. Sometimes it is said that what the 1st Amendment forbids is all legal concern with religion, all legal distinctions drawn in terms of religion, whether their effect upon worship would be

favorable or unfavorable. A third general principle is that of neutrality toward religion, assuring "external" freedom of worship by forbidding government restraint and "internal" freedom of worship by forbidding government support. No one of these principles can consistently explain all aspects of American law and practice in church-state relations. Some of the points at which the principles differ in their practical application are noted in the sections that follow. The neutrality principle seems preferable in that it affords the greatest protection to freedom of worship.

Before considering further the constitutional limitations, it should be noted that full enjoyment of religious freedom requires not only freedom from government action but also freedom from the social pressure springing from intolerance. Most dramatic among many signs of the spread of religious tolerance in the United States was the election in 1960 of a Roman Catholic (John Fitzgerald Kennedy) as president. Notwithstanding such signs, toleration is by no means unlimited, and its limitations are often revealed in the sharp controversies which have been touched off by some of the court decisions expanding the legal protection of freedom of worship.

**"Free Exercise" of Religion.**—Neither federal nor state authorities can regulate religious worship as such, but constitutional protection of the free exercise of religion does not mean a broad religious exemption from general laws imposed for the public health, safety, or morals. Freedom of worship has been held not to justify the early Mormon practice of plural marriage, nor does it cover rites involving the use of narcotics or the handling of poisonous snakes. Compulsory high school attendance has been enforced against the religious convictions of the Old Order Amish; religious scruples against blood transfusion have been overruled where lives of children were at stake; and child labor laws have been applied to children selling religious literature on the street. On the other hand, religious freedom has been held to require exemption from compulsory flag salutes in public schools and also exemption from permit requirements for the use of streets and parks for proselytizing.

Freedom of worship was one of the main reasons for the Puritans settling in the New World. Here they are seen leaving Holland.

The Bettmann Archive



General principles of church-state relations are of little help in working out the limits of the "free exercise" clause. The decisions have apparently involved a weighing of the importance of the purposes served by the various regulations, on one hand, against the value of unrestricted freedom of worship, on the other. The difficulty of drawing a balance is illustrated by a case on which the Supreme Court twice divided without a majority decision on the main issue: a mail fraud prosecution of a cult leader for making false claims of spiritual powers with intent to deceive.

**"Establishment of Religion" Clause.**—This clause obviously forbids giving to a particular church a preferred position. While this may have been the extent of its original meaning, the clause has been interpreted to forbid also the giving of "aid to all religions." The position that churches should be kept free from government aid had been eloquently supported by James Madison in his *Memorial and Remonstrance Against Religious Assessments* (1785). This document was an argument against a bill in the Virginia legislature to levy a tax for the support of "Teachers of the Christian Religion." Taxpayers were to have the privilege of designating the particular "society of Christians" to which the tax should be paid, and for those who made no such designation the tax proceeds were to be applied by the legislature "for the encouragement of seminaries of learning." It is agreed that the 1st Amendment forbids any such legislation, even if non-Christian bodies were included and even if persons who have no religious affiliation were exempt.

Interpretation of the "no establishment" clause as forbidding nondiscriminatory aid raises questions concerning the tax exemptions which have been firmly entrenched in American practice from the beginning. Some exemptions are clearly defensible, such as the federal income tax deduction for religious charities. Since the tax code permits deduction of contributions to nonreligious charitable and educational enterprises, permitting deduction also of contributions to similar religious enterprises represents no departure from the neutrality principle. Some laws, however, grant to churches a special tax exemption not extended to similar nonprofit organizations. Such exemptions operate as subsidies of religion, and they represent historical survivals which are difficult to defend now that it is agreed that direct appropriations to churches would be improper, however impartially they might be administered and however highly the churches may be valued for their contributions to social morality.

**Protecting Freedom of Worship.**—In other areas also, exemptions designed merely to protect freedom of worship are sometimes attacked as laws "respecting an establishment of religion." For example, many Sunday closing laws exempt those whose religious beliefs require them to close their places of business on some other day. The closing laws themselves are sustained only on the ground that they are not now intended to serve religious ends. It is now settled that the exemption of merchants who observe the seventh-day Sabbath is constitutional, although such exemptions are clearly inconsistent with both the separation principle and the principle forbidding legal distinctions in terms of religion. In granting such exemptions, legislatures are recognizing the fact of religious differences and the inequality of burden which would result from laws which con-

tain no exemptions. The drafters are thus not trying to aid religion, but to maintain religious neutrality and to avoid restricting freedom of worship. Exemptions of clergy and divinity students from military service are defensible on similar grounds. While the "free exercise" clause does not require Congress to grant such exemptions, neither does the "no establishment" clause forbid them.

The same justification applies in many other situations where strict separation of church and state is not observed. For example, if the United States Defense Department were required to have nothing to do with worship, the result would be a limitation of the religious freedom of service personnel on Army posts and naval vessels. Government provision of facilities for worship is not a policy designed to promote religion but a neutral policy of avoiding unnecessary restraint of freedom of worship. Such government action extends the freedom of worship beyond the area of the constitutionally protected "free exercise" of religion.

There are many other areas in which the government has made no attempt at strict church-state separation but, on the contrary, has shown active concern for the religious freedom of those over whose lives it has taken a large measure of control. Two such areas have been the Indian reservations and government-owned communities like those established around atomic installations. Similarly, public urban redevelopment programs have often involved government action making land available for religious as well as nonreligious institutions.

Perhaps the clearest example of the impracticability of complete church-state separation is in the situation where a child becomes the ward of the state. Whether he is placed in a public or a private institution or in a foster home, the matter of religious upbringing cannot be ignored, and similar problems arise in many adoption cases. The resulting problems are by no means simple, and they often involve bitter religious controversy. However, it would be impossible without practical hostility to religion to insulate courts and welfare authorities from religious concerns. The Constitution does not require (to quote the language of the Supreme Court) "a callous indifference to religious groups. That would be preferring those who believe in no religion over those who do believe."

**Public Education.**—In 1962 the Supreme Court held that the "no establishment" clause prevents a state from prescribing a prayer for use in public schools, although its authors had attempted to avoid sectarianism. Even with provisions excusing individual pupils who object, any prescription of worship in public schools seems clearly an effort to inculcate religious belief and practice; it is therefore inconsistent with the maintenance of state neutrality toward religion. This decision had been preceded by two cases involving arrangements for released-time instruction in sectarian religion, invalidating a program which used public school buildings and sustaining one which avoided this feature.

Programs condemned in these cases should be distinguished from proper use of the Bible in public schools in the same way as other books are used, and from objective teaching about religion which is not designed to induce belief or habits

of worship. State universities thus may have departments of religion and courses in particular religious traditions. (Thomas Jefferson, author of the phrase "a wall of separation between church and state," even included sectarian schools of divinity in his plan for the University of Virginia.)

At the elementary school level, it may be difficult to devise ways of teaching about religion while maintaining neutrality. Ignoring religion, however, involves an equal danger of violating neutrality by inculcating secular humanism. Education in a democracy should include, in any event, teaching about the value of freedom of worship. It is of vital importance for a democracy that its citizens have deep-rooted belief in the dignity of man and his capacity for growth in responsible freedom. It is therefore important that pupils should learn respect for the ways in which different groups find sustaining roots for such belief in various religions and philosophies.

**Religious Schools.**—In 1925 the Supreme Court held that a state may not require all children to attend public schools. The decision was made at the suit of a military academy as well as a parochial school and was not placed on the ground of religious liberty. Subsequent problems have related principally to financial support. In the United States, religious schools have not derived any of their support from tax funds, contrary to the practice in certain other countries; proposals for federal aid to education have periodically raised controversies over whether religious schools may be included in such programs without violating the "no establishment" clause. Students in religious schools have shared in a number of federal programs, including those relating to school lunches, veterans' education benefits (the so-called G.I. Bill), national science scholarships, and the education of congressional page boys. None of these programs, however, has come before the Supreme Court.

The court held in 1947 that a state provision for reimbursing the bus fares of parochial school pupils did not violate the "no establishment" clause. The court interpreted the clause to forbid general aid to religion but added that "... we must be careful, in protecting the citizens of New Jersey against state-established churches, to be sure that we do not inadvertently prohibit New Jersey from extending its general State law benefits to all its citizens without regard to their religious belief." The court thus applied the neutrality principle and rejected the requirements of strict segregation. By the same reasoning one can justify broader efforts to avoid religious discrimination in financing the costs of education in nonreligious subjects. The failure of many Americans to accept this point may reflect an unwillingness to support full freedom of those who believe in parochial schools.

Constitutions of many of the states have provisions concerning religion which are more specific than those of the 1st Amendment. A common clause is one which in varying terms forbids the use of public funds for religious schools. These clauses are sometimes interpreted as forbidding state action which the federal Constitution leaves the states free to take; thus a number of state courts have invalidated appropriations for bus transportation or textbooks for pupils in parochial schools. Other courts, however, have held that

such appropriations involve merely nondiscriminatory aid to students and not support of religious schools within the meaning of their constitutional prohibitions. State scholarship programs have often included students in denominational colleges.

**Prospects.**—The special contribution of the United States to the development of freedom of religion has been the policy of neutrality—particularly two aspects of this policy. These aspects may be expressed in two propositions which are reflected (however incompletely) in American law and practice. The first is the proposition that worship is free only when it stands without the backing of government. The second proposition marks the limit of the first: it is not an improper backing of religion for the government to express its concern for freedom of worship by measures which merely neutralize what would otherwise be restrictive effects of government action.

Wider acceptance of the first proposition probably will come about only through deeper understanding of the reasons for religious freedom. Freedom of worship is not merely a practical policy expedient for keeping peace in a pluralistic society; it is an integral part of religious belief. When government punishes heresy, it not only violates the freedom of the heretic but also renders unfree the religious commitment of the orthodox. The very nature of worship requires that worship be free. Modern writers in increasing number are expounding such views—not only writers in the tradition of "liberal religion," but also Roman Catholics and orthodox Protestant and Jewish spokesmen.

Distrust between religious groups sometimes blocks the acceptance and application of the second proposition (that government may affirmatively promote religious freedom). For example, hesitation to support arrangements that would increase the religious freedom of groups committed to parochial schools sometimes reflects distrust as to the devotion of one or more of these groups to the principle of religious freedom. Wider support for legislation maximizing freedom can be expected only as it becomes widely apparent that the major religious groups have in common a trustworthy belief that worship should be free.

See also RELIGIOUS LIBERTY.

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**WORSHIP, Household.** From immemorial time mankind has communed with the Deity not only in public religious services and private devotions but also through domestic worship performed in dwellings and conducted usually by the head of the household. Household worship includes such rites as sacrifice, prayer, song, feast, purification,



adoration of holy images of various types, and reading from or recital of sacred literature. In popular practice, domestic devotions have been extended to (1) worship of the family's deceased members, principally its progenitors (see ANCESTOR WORSHIP); (2) propitiation of celestial phenomena and of various forms of animal and vegetable life, including their personification (see ANIMAL WORSHIP; NATURE WORSHIP; MYTHOLOGY); and (3) invocation of divine benediction at the family's meals, usually before eating, a practice common among Jews and Christians. Although there are exceptions, household worship generally lingers longer in rural districts, where life is more leisurely and the family is more cohesive, than in urban communities, where public places of worship are more numerous and accessible, people are more sophisticated, and the tempo of life is swifter. Since most literature dealing with man's relation to the Deity is concerned primarily with corporate or public worship, evidence for domestic, as distinct from personal and private, worship, depends principally upon incidental and casual references.

Among tradition-minded families throughout the Mediterranean area, ancient household devotions persisted until they were submerged by the rising tide of Christianity, which became the official religion of the Roman Empire in 380; such earlier domestic rites as survived thereafter in the Near and Middle East and North Africa succumbed to the Islamic conquest after the mid-7th century. There is scant evidence about household worship in northern Europe before the Christianization of that region began in the 7th century, in the Americas before the 15th century, or in sub-Saharan Africa and the Pacific islands before the mid-19th century. But it is certain that whatever household worship existed among these peoples, its principal purpose was to win divine favor for the family and to avert demonic influences. In the Far East, domestic worship in China, Japan, and India has descended from antiquity to modern times without serious interruption, surviving principally among the populace in rural areas.

**Ancient Babylonians and Egyptians.**—Our knowledge of domestic religious services among ancient peoples, apart from classical and Oriental practices, is imperfect, because the literary and archaeological materials available contain little data on the subject. It is believed, for example, that household worship, involving prayers and offerings to departed ancestors, existed among the Babylonians, although the spirit of Babylonian worship apparently asserted itself rather in communal or private worship. There is abundant evidence about private devotions, including poses assumed, gestures made, oblations offered, and prayers said or sung, but this bears largely upon the worshiper in the presence of his deity in a temple and is not absolutely applicable to domestic worship.

In Egypt, a sepulchral mural portrays a peasant with his family praying in his field—a variation of worship in a house—before a sycamore tree, beside which they have placed offerings of fruit, bread, and water. This scene is indicative of one form of nature worship, which was widespread among primitive people. Several representations of persons adoring their domestic animals, such as cattle, cats, and birds, exist. Snakes, as protectors of the household, were propitiated with offerings of milk. The ordi-

nary house had a shrine—a wooden cupboard or a small niche in the wall—containing clay or bronze miniature figures of various deities and sacred animals, with a lamp burning before the images. Domestic worship was practiced before such shrines, but we know little about the ritual.

**Jews.**—Among the ancient Hebrews, the Sabbath was from remote antiquity a day devoted to acts of worship. In the Hebrew household the Sabbath's normal three meals were preceded by paternal sanctification and followed by the singing of hymns. Preeminent among the household devotions was the celebration of the Passover, instituted on the eve of the Israelite exodus from Egypt (Exodus 12:3-14) in the 13th century B.C., with which was associated the Seder or family feast, religious in character. Although changed civil and economic conditions have wrought minor changes in these celebrations, the modern Orthodox Jewish family's observance of the Sabbath and Passover remains basically the same as it was 30 centuries ago. See also JEWISH HISTORY AND SOCIETY—19. *Religious Traditions and Customs*. PASSOVER; SABBATH.

**Persians.**—The Persian householder, surrounded by his family, worshiped the hearth fire daily by sacrificial offerings of fragrant fuel. Zoroastrianism held that fire was a holy flame, and the worshiper prayed that it might ever burn in his house. The hearth fire, in return for proper adoration, blessed the family with life and valor, holiness and wisdom, cattle and children. Sacrifices were made also to certain celestial divinities, such as Sraosha, who befriended the family; Mithras (Mithra), who rewarded the truth-speaking family with material blessings; and Haoma, who conferred health and happiness on the household. The family turned for protection also to the Fravashis, guardian spirits of the dead; with oblations, sacrifices, prayers, and hymns the family invoked their benedictions on the anniversary of a member's death. The Fravashis consequently blessed the household, protected it from enemies, and caused the householder's children and cattle to prosper.

In modern Iran, some 20,000 Gabars still practice Zoroastrianism and follow the ancient rituals, with a room in a quiet part of the house set aside as the fire temple. For the Parsis, Indian followers of Zoroaster, numbering more than 100,000 and settled near Bombay, the ceremonial fires are more usually kept in special buildings, from which nonbelievers are generally excluded. The Parsis believe that the Fravashis revisit the homes of their descendants during the 10-day festival in their honor at the end of the year.

See also ZOROASTRIANISM.

**Ancient Greeks.**—Among the Greeks, household worship was centered about the hearth. Hestia, goddess of the hearth, was propitiated at the beginning of the family's meals by offerings of small portions of food. The Good Daimon, believed to be the good luck of the house, was worshipped by pouring a little wine onto the floor whenever wine was drunk. At banquets, which were concluded by wine parties, the start of the drinking bout (Gr. *symposion*; Lat. and Eng. *symposium*) was signaled by pouring three libations: to Zeus, king of gods and men; to the heroes; and to Zeus Soter (Zeus the Savior), a shadowy domestic divinity. Exact recital of ritualistic words was required; otherwise the rite was in-

valid and its repetition was necessary. Household worship was indicated particularly when a member of the family undertook an important activity outside the family circle, especially when departing on a hazardous journey or for war.

**Ancient Romans.**—In Rome the paterfamilias, or father of the family, was the household priest and conducted the domestic devotions. Devout Romans prayed and sacrificed every morning, but the customary time for familial worship was toward the end of the daily dinner, when offerings of food and drink were made to Vesta, goddess of the hearth; to the family's tutelary deities, the Lares; and to the guardian spirits of the family's larder, the Penates. The reverence accorded to these divinities gave to every religious Roman's house something of the sanctity of a temple. Their miniature images were enshrined near the hearth in a niche, which might also contain statuettes of deities worshiped privately by members of the family. Propitiation of the Lemures or Larvae, the spirits of the dead, was another aspect of Roman domestic worship. See also LARES; LEMURES; PENATES.

**Chinese.**—The Chinese worshiped particularly such household divinities as the housegate god, the door god, the hall god, the god of the walls, and the kitchen god, whose images were enshrined usually in the main room of the house. On New Year's Day the head of the household led his family in worship of these deities, after which the family feasted on delicacies. Family sacrifice to its ancestors was by oblations, which might be cakes, cereals, melons, water, wine, flowers, incense, jewels, and small animals; such devotions were performed before tablets containing the ancestors' names. Funeral services in the house also called for common participation by the family, which prayed and sacrificed for the deceased member's well-being in the spirit world. Today the ancestral shrine with its inscribed tablets is still the center of family life in religious Chinese homes. Food sacrifices are offered there, proposals of marriage received by a girl's father, and other important announcements and decisions made, in the presence of the ancestors.

**Japanese.**—The family sanctuary was almost universal in Japan. The household was inspected periodically by the neighboring priest to see that it had a proper place of worship. This sanctuary was the so-called god shelf, on which were placed likenesses of such deities as the family favored. Worship was periodical and at the family's preference; but the observance of New Year's Day called for a special religious ceremony by the family, which offered prayers, oblations, and incense to win divine protection throughout the year. Funeral services were conducted in the house and were considered an aspect of household worship because the surviving relatives prayed for the welfare of the deceased's spirit. In modern Japan believers still worship at the home's god shelf, where sacrificial offerings are made and special occasions are celebrated.

**Hindus.**—The ancient Hindus worshiped Jara, goddess of the house, with perfumes, flowers, incense, and food placed before her painted image; in return, she promised children. An image of Naga, a harmless snake, was worshiped with sugar, rice, and millet to divert venomous serpents from the house. In some sections of India a

family fetish, a wooden stake, was set in the ground outside the house door and was worshiped periodically. Hardly a household was without its tutelary deity, usually represented by some crudely carved likeness or symbol in homely shrines or over doorways. This divinity was worshiped as one who delivered the family from calamities, actual and potential, believed to be due to demons. Purificatory rites, consisting of prayers, ablutions, libations, and oblations, were performed daily and particularly on occasions of marriage, birth, and death. The hearth fire was worshiped daily (morning and evening) by the family, which prayed, sang hymns, and fed the sacred fire with wood, rice, and butter. To a pious Hindu, every 14th day was a high and holy day, marked by special family observances. Sacrificial cakes, prepared from rice and butter, were cast into the hearth fire in the names of various deities, while sacred songs were sung.

Each house had a small wooden temple as a sacred shrine for the household divinities, generally five consecrated symbols representing the chief Hindu gods. These symbols were usually stones: black for Vishnu, white for Shiva, red for Ganesha, multicolored for Shakti, and a crystal for the sun. Before these stones, arranged on a circular metal disk, domestic worship was celebrated daily after proper purification of the family members. It consisted of at least 16 stages, during each of which a sacred verse was recited. Offerings included water, milk, honey, butter, porridge, and assorted cereals. In India today an image or symbol of a tutelary deity is enshrined in most homes and a priest or member of the family conducts the traditional domestic rites before it.

**Modern Christian Practices.**—Apart from the Jewish practices previously described, the domestic worship with which most people in English-speaking countries are now familiar is the Protestant Christian household service, which originated during the Reformation, when the principal reformers of the 16th century conducted household worship as an adjunct to congregational worship even after the Protestants had their own churches. In modern times, the assembly of the household about the so-called family altar (as the service commonly is called) occurs principally in the families of Protestant clergymen, either daily or on Sunday, usually before or after breakfast, but occasionally in the evening. Here and there among the pious laity such services also occur, ordinarily only on Sunday. The worship is short and simple. It includes normally, although exceptions and variations exist: (1) reading of a Biblical passage, customarily by the father of the family, (2) an extemporaneous or occasionally set prayer, ordinarily also by the father; and (3) singing a hymn, with or without musical accompaniment, by all the family. Sometimes the reader from the Bible or another (older) person will offer a brief meditation on the reading by demonstrating its pertinence to historical or modern times.

In the British Isles, services in the home became common after the Continental Reformation and were widespread in Scotland, where they still are strong among Presbyterians. Some vestiges remain in Wales and in Northern Ireland and among Anglican churchmen in England. Household worship in the United States can be traced to the colonial period, particularly in New England, where the Pilgrim Fathers introduced it in



Manseil Collection, London

This scene of a Scottish family's home worship was inspired by Robert Burns' *Cotter's Saturday Night*.

1620. Before the Revolutionary War, 18th century German immigrants brought their native practice with them, notably into Pennsylvania. Settlers, moving westward in their wagon trains, carried the custom into the Western states. But by World War I household worship was vanishing from the domestic scene, except in tradition-loving families of pious heritage.

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**WORSTEDS.** See WOOL—Uses and Manufacture.

**WORT**, a dilute solution of sugars. See BEER—Brewing of Beer.

**WORTH**, wŭrth, **William Jenkins**, American general: b. Hudson, Columbia County, N.Y., March 1, 1794; d. San Antonio, Texas, May 7, 1849. He received a common school education and was employed in business until the War of 1812 began, when he was commissioned a 1st lieutenant in the Army, serving at Chippawa, Lundy's Lane, and Niagara. Brevetted major, he remained in the Army after the war, although lamed by a wound. From 1820 to 1828 he was commandant of cadets at the United States Military Academy at West Point and in 1838 became colonel of the 8th Infantry.

In 1841–1842 Worth had the chief command in the Seminole War in Florida and was brevetted brigadier general for his services. In the Mexican War (1846–1848) he joined Gen. Zachary Taylor's forces and at the Battle of Monterey (Sept. 21–24, 1846) led a turning movement that entered the city from the south and contributed largely to the victory. He was brevetted major general and received a sword from Congress. In Gen. Winfield Scott's march from Veracruz (1847) he fought with distinction at Cerro Gordo, Churubusco, Chapultepec, and the storming of Mexico City.

Though a skillful and intrepid battle leader, Worth was a poor administrator. He was called to account by Scott for his conduct as occupation governor of Puebla and later gratified his grudge against the general by an intrigue designed to discredit Scott and glorify himself. He was arrested but was freed by President James K. Polk and placed in command of the Department of Texas. Fort Worth, Texas, was named for him,

and a monument to his memory was erected by the City of New York in 1858.

**WORTHING**, wŭr'eth-ing, municipal borough, England, in Sussex, on the English Channel, 50 miles south-southwest of London. It is a seaside resort and residential town extending inland to the South Downs, which shelter it from the north. It has an exceptionally mild winter climate, and large quantities of grapes and tomatoes are grown for the market. There is a pier with a pavilion, parks and gardens, and an art gallery and museum containing Roman relics. The borough includes large parts of the South Downs, and its northernmost point is marked by Cissbury Ring, the remains of a walled hill city occupied from 300 to 50 B.C., and by numerous flint pits worked as long ago as 2,000 B.C. Pop. (1961) 80,143.

H. GORDON STOKES.

**WORTHINGTON**, wŭr'thing-tŭn, **Henry Rossier**, American inventor: b. New York, N.Y., Dec. 17, 1817; d. Tarrytown, Dec. 17, 1880. In 1840 he began a series of experiments with steam for the propulsion of canal boats and devised a small steam pump to be used in the maintenance of the water supply in the engine boiler. In the following year he patented an independent feed pump, the predecessor of the direct-acting steam pump which he patented in 1849. Subsequently, in Savannah, Ga., Worthington built the first direct-acting compound engine to be installed in a waterworks. In 1859 he invented the duplex steam feed pump, still used in the 20th century. He also devised various improvements in steam and hydraulic machinery.

**WORTHINGTON**, city, Minnesota, seat of Nobles County, on Lake Okabena, 60 miles east of Sioux Falls, S.Dak., and 10 miles north of the Iowa border. It is a trade center in a diversified agricultural area; chief industries include processed poultry, farm sprayers, luggage carriers, ice cream, concrete products, and alfalfa meal. There is a municipal airport. Worthington Junior College, the Worthington Crippled Children's School, and the Nobles County Library are situated here. The community was established as a temperance colony in 1871 and was named Okabena, an Indian word meaning "the nesting place of herons." Government is by mayor and council. Population: 9,977.

W. R. BASSETT

**WORTHINGTON**, city, Ohio, in Franklin County, on the Olentangy River, adjoining the northern border of the state capital, Columbus. It is mainly a residential community, with some industry in the outskirts. Two miles north of Worthington is the Pontifical College Josephinum. The Ohio Railway Museum and the Worthington Historical Society Museum are points of special interest in the city. Worthington was settled in 1803, by 11 families from Connecticut, whose leader, James Kilbourne, proposed that the village be named in honor of his friend and benefactor, Thomas Worthington, one of Ohio's first United States senators and later governor. The New England background of the founders is visible in the village green that still marks the center of the city and in the churches and other buildings dating from as early as 1804. Government by city manager was adopted in 1957. Population: 14,869.

ELMA A. WHITNEY.

**WOTTON**, wŏt'ən, Sir Henry, English diplomat, educator, and minor poet: b. Boughton Malherbe, Kent, England, March 30, 1568; d. Eton, December 1639. He attended Winchester School and Oxford University, where he began a lifelong friendship with John Donne. He then spent several years traveling and studying language, art, architecture, and chemistry in France, Germany, Switzerland, and Italy. After returning to England, he became secretary in 1597 to Robert Devreux, 2d earl of Essex, whom he accompanied on two expeditions against the Spanish and on the ill-starred Irish adventure.

Although not a party to Essex's plans, Wotton decided not to return to England when Essex fell, but went first to France and then to Italy. Ferdinand I de' Medici, grand duke of Tuscany, sent him to warn James VI of Scotland of an impending assassination. In gratitude James, when he came to the English throne as James I in 1603, knighted Wotton and named him ambassador to Venice, where he served intermittently during the next 20 years. A witty comment concerning the role of an ambassador brought him temporarily under James' disfavor in 1612; but Wotton apologized, supported the king in Parliament, and eventually returned to ambassadorial duties on the Continent. He devoted himself particularly to the affairs of the queen of Bohemia, King James' daughter Elizabeth.

In 1624 Wotton returned to England for good. His salary was in arrears, and he renewed his entreaties for preferment from the king. He also published *The Elements of Architecture* at this time and received from James the provostship of Eton College. Since Wotton felt the position required him to take religious orders, he did so and spent the rest of his life studying divinity. Feeling death near, he ordered his tombstone inscribed in Latin with the sentence (in translation): "The itch of disputation will prove the scab of the church." Weakened by asthma, he died of a fever.

Wotton wrote many letters and essays. Some of them were gathered together with his poetry, character sketches, and observations on famous people of his acquaintance by his friend Izaak Walton, who prefaced the collection, *Reliquiae Wottonianae* (1651), with his famous *Life of Sir Henry Wotton*. Wotton's reputation as a poet rests upon the slender foundation of some two dozen poems, but the exquisite lyrics *On His Mistriss, the Queen of Bohemia, The Character of a Happy Life*, and *A Description of Spring* justify his claim to that honored name.

DONALD B. CLARK  
University of Missouri

**WOTTON**, William, English scholar and clergyman: b. Wrentham, Suffolk, England, Aug. 13, 1666; d. Buxted, Essex, Feb. 13, 1727. He read Latin, Greek, and Hebrew before he was old enough to attend school. After graduating from Catherine Hall, Cambridge, in 1679, he served as librarian to Bishop William Lloyd. Returning to Cambridge, he received the M.A. in 1683 and the B.D. in 1691, at which time he was ordained. As a scholar of wide interests, Wotton wrote several historical and scientific treatises, including *An Examination of Dr. Woodward's Account of the Deluge* (1697); *The History of Rome from the Birth of Antoninus Pius to the Death of Severus Alexander* (1701); and *A Discourse Concerning Confusion of Languages at Babel* (1730).

written in 1714. His best-known work was a defense of modern learning, *Reflections upon Ancient and Modern Learning* (1694), which pointed out Sir William Temple's errors in his essay *Of Ancient and Modern Learning* (1690). The *Reflections* called down upon Wotton's head the wrath of Jonathan Swift, which exploded in Swift's now famous *The Battle of the Books* (1704).

DONALD B. CLARK  
University of Missouri

**WOUK**, wŏk, Herman (1915– ), American novelist. He was born in New York City on May 27, 1915. He completed an A.B. degree at Columbia University, where he also edited the college humor magazine and wrote varsity shows. He then became a radio scriptwriter, working with Fred Allen from 1936 until June 1941. During World War II he was in the United States Navy and began his first novel during off-duty hours at sea. This work, *Aurora Dawn* (1947), a popular satire of the New York advertising business, was followed by *The City Boy* (1948), a humorous and partly autobiographical story of a Bronx boy, and *The Caine Mutiny* (1951), a Pulitzer Prize novel of events aboard a naval vessel. In *Marjorie Morningstar* (1955) a Jewish girl finds happiness in suburbanite social conformity; in *Youngblood Hawke* (1962) a talented young author is caught up in the intrigue of the publishing world. Other works include plays, motion-picture scripts, and a study of Jewish orthodoxy, *This Is My God* (1959). Later novels include *Don't Stop The Carnival* (1965), *The Winds of War* (1971), *War and Remembrance* (1978), and *Inside, Outside* (1985). Most of Wouk's novels won popular acclaim. They display narrative skill, satire, occasional humor, and a tendency to favor conventional taste.

WILLIAM BRACY, Beaver College

**WOUND**, wŏnd, a traumatic disruption of the continuity of any body tissue. The term usually suggests accidental injury, but surgeons inflict intentional wounds in practically all operations.

**Types of Wounds.**—Wounds may be classified according to the causative agent, either specifically, such as knife, bullet, or shrapnel wounds, or generally, such as burn or crushing wounds. Surgeons usually classify wounds on the basis of their gross appearance: *incised*, a sharp, clean cut due to a cutting instrument; *lacerated*, a more jagged, irregular wound; *contused*, a wound in which the edges are crushed; *avulsed*, a wound in which some of the tissue is torn away; *penetrating*, a deep wound entering, for example, the chest or the abdomen; *puncture*, a deep wound with a small external opening; and *nonpenetrating*, injury to subcutaneous tissue or viscera without disruption of the body integument. Certain types of wounds and those involving specific tissues may be further subdivided. Fractures (wounds of bone) are classified by descriptive terms such as spiral, comminuted, and impacted. Burns are categorized as first, second, or third degree depending on the depth of tissue injury.

**Healing of a Wound.**—The healing of a wound is a complex physicochemical process that is only partly understood. Healing may be affected by many factors in the wound and in the body generally, either adversely or beneficially. After a wound has been made, several changes occur simultaneously. Bleeding either stops spontane-

ously or is controlled by bandaging or other means. Dead tissue is removed by the body or by cutting it out (debridement). If the surfaces of the wound are in fairly close contact, the space is filled by blood and tissue juices, which, in addition to other functions, effectively seal the wound. A scaffold consisting of a fine network of protein molecules called fibrin then forms, and into this grow two of the tissues essential for repair. These are connective tissue cells (fibroblasts and histiocytes) and tiny capillary blood vessels. At this stage the repair tissue, called granulation tissue, can be seen in a healing open wound as a red, velvety granular surface. As time passes, several changes take place simultaneously. The fibroblasts produce a fibrous protein called collagen, which gives the wound strength. The histiocytes scavenge cellular debris, foreign bodies, and blood seepage. And the capillaries decrease in number and nearly disappear. The replacement of red capillaries by white collagen explains why a new scar is red at first but then gradually becomes white over the course of several weeks. See also BLOOD—Clotting; CONNECTIVE TISSUE.

One measure of the progress of healing is the strength of a wound. A sutured wound loses strength slightly for 2 to 4 days and then rapidly gains strength up to the 7th and 14th day, following which a slow gain in strength is typical. This slow gain then may continue for several weeks.

**Factors Affecting Healing.** Local factors that affect healing include the type and location of the wound, amount of dead tissue, number and kind of bacteria, presence and type of foreign bodies, blood supply of the wounded part, and the treatment given. A foreign body in a wound may be absorbed by the tissues, which is what happens to catgut used to close a wound; or it may be encapsulated (surrounded by scar tissue), as might happen to a small piece of glass, or extruded, as in the case of a splinter that stays in a wound for some time and then appears on the surface. General body factors that affect healing include age; the presence of certain diseases; and nutrition, especially adequate amounts of protein and vitamin C.

**Prevention of Infection.** Surgeons take elaborate precautions to prevent infection of the operative wound. Operating rooms are isolated and the air filtered to remove bacteria. Ultraviolet lights may be used to kill the bacteria in the room. Surgeons and nurses wear special clothing, including masks. Gowns, gloves, linens, instruments, and all other materials used in the operation are sterile. The skin in the area of the surgery is prepared with antiseptic agents, and the wound is carefully protected. Antibiotics are sometimes administered.

Accidental wounds are infected when they occur, but the virulence of the infection varies. The wound should be protected with a clean dressing. Water may be used to irrigate the wound, but strong antiseptic agents should not be placed in the wound, as viable cells will be destroyed. A minor cut may be washed with water and dressed with petroleum jelly. A more serious wound should be attended to by a physician.

See also FIRST AID—Wounds and Bleeding.

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**WOUNDED KNEE** was an engagement between Big Foot's band of Miniconjou Sioux and the 7th U.S. Cavalry at Wounded Knee Creek on the Pine Ridge Reservation, S. Dak. The encounter, which became known as the Wounded Knee massacre, took place on Dec. 29, 1890.

Wounded Knee marked the culmination of the Ghost Dance "war" of 1890–1891, the last major armed conflict between Indians and whites in the United States. When hunger, disease, loss of reservation lands, and broken government promises left no other hope for a satisfactory life, the Sioux had turned to the Ghost Dance religion that had been proclaimed by the Paiute mystic Wovoka.

In November 1890, alarmed by the dance and the growing militancy of the Indians, the Pine Ridge agent called for troops. Gen. Nelson A. Miles assembled an army ultimately numbering more than 5,000 soldiers and attempted to end the troubles without violence. On December 15, however, Chief Sitting Bull was killed at his camp during an attempt to arrest him. On December 28 the 7th Cavalry intercepted Big Foot and his band of some 350 people as they were fleeing south to the Pine Ridge Agency from their village on the Cheyenne River. The federal troops rounded up the Sioux and placed them in a camp on Wounded Knee Creek, 2 miles (32 km) northeast of the agency.

On the morning of December 29 the cavalry, about 500 strong and commanded by Col. James W. Forsyth, attempted to disarm the Sioux. Neither side expected or intended to fight, but the confrontation stirred rising emotions. A medicine man incited the young men to resist. Fire broke out. The bloody face-to-face encounter and shots from four small cannons posted on nearby hills took many lives. Sioux casualties were counted at 153 dead and 44 wounded, about half of whom were women and children. Those who survived were pursued and butchered by the U.S. troops. Big Foot was slain in the first fire. Losses among the cavalry numbered 25 killed and 39 wounded.

The battle doomed General Miles' effort to avoid bloodshed. Four thousand Indians stampeded and barricaded themselves in a large camp north of Pine Ridge Agency. But in less than three weeks, by a skillful combination of diplomacy and threatened force, Miles ended the violence. He preferred charges against Colonel Forsyth for Forsyth's part in the bloodshed, but a court of inquiry exonerated him.

Then and later many people regarded Wounded Knee as a massacre. To subsequent generations of Indians, it symbolized the injustices and degradations inflicted on them by the U.S. government. In 1973, militants of the American Indian Movement chose the battlefield as a site to dramatize Indian aspirations. About 200 Indians occupied the village of Wounded Knee and alternately traded shots and negotiated with surrounding federal, state, and tribal law-enforcement officers. Two Indians were killed, several persons were wounded, and the village was almost destroyed. The "Second Battle of Wounded Knee" held public attention for days, until the militants surrendered, having succeeded in drawing publicity for Sioux grievances.

ROBERT UTLEY, National Park Service  
Author, "The Last Days of the Sioux Nation"



**WOUWERMAN**, vou'vər-măn, **Philips** (1619-1668), Dutch painter of naturalistic genre scenes. Wouwerman (Wouwermans) was born in Haarlem and baptized on May 24, 1619. Trained by his father, Pauwels, and possibly by P. C. Verbeeck and Frans Hals, he was a member of the Haarlem painters' guild in 1640. Many of the more than 1,000 paintings attributed to him may have been done by his brothers Jan and Pieter, with whom he collaborated, or by imitators.

Wouwerman's work shows the influence of Jacob van Ruisdael and Jan Wijnants in its delicate landscape treatment and especially of Pieter van Laer, painter of Roman genre scenes, in its subject matter—chiefly battle scenes, military camps, hunting parties, and innyards. Most of his works include horses, as for example, the *Halt of a Hunting Party* (Dulwich College Picture Gallery, London) and the *Cavalry Camp* (Frick Collection, New York). There are also a few religious and mythological scenes. It was, however, Wouwerman's graceful, tranquil handling of familiar subjects that made his work extremely popular with the merchants of the Netherlands and France. He died in Haarlem on May 19, 1668.

**WOVOKA**, wō-vō'kə (1856?-1932), was a Paiute Indian mystic. He was born near Walker Lake, Nev., about 1856. His name means "The Cutter." Said to be the son of Tavibo (Tavito) a Paiute religious leader, Wovoka was a medicine man who led a quiet life among the Paviotso, the northern branch of the Paiutes. For a time he worked for a white settler, David Wilson, and was known among the whites as Jack Wilson.

About 1889, Wovoka had a spiritual experience that foretold the coming of a messiah who would restore to the Indians their lost lands and warriors. He prescribed symbolic dances and songs as preparation for the messiah's coming. Known as the Ghost Dance, the ritual swept most of the Indian tribes from the Plains to the Rockies. The Ghost Dance contained elements of Christian theology that Wovoka had learned. Although pacifism was the soul of Wovoka's teachings, apprehension and mutual distrust swept the frontier and led to the Sioux outbreak of 1890, often called the Messiah or Ghost Dance War.

The killing of Chief Sitting Bull and the massacre on Dec. 29, 1890, of more than 150 Indians at Wounded Knee, S. Dak., shattered faith in the cult, and it quickly died down. Wovoka spent his remaining years in obscurity. He died in Schurz, Nev., on Sept. 20, 1932. See also GHOST DANCE; WOUNDED KNEE.

**WOZZECK**, vō'tsek, is an opera by the Austrian composer Alban Berg, which is regarded as perhaps the most important, impressive, and successful of modern operas. It was composed between 1917 and 1921 and was first performed in its entirety in 1925 in Berlin. It had its American premieres in 1931 at Philadelphia and then in New York City at the Metropolitan Opera.

As the source of his libretto, Berg used a simple abbreviation of the tragedy *Woyzeck* by the early 19th century German dramatist Georg Büchner. *Woyzeck* had been rediscovered by the German expressionist dramatists, and Berg owed much to their exploitation of the sordid and of the subconscious.

Wozzeck, an impoverished soldier subject to hallucinations, is tormented by his sadistic cap-

tain and regimental doctor. His common-law wife Marie leaves him for a brutal drum major, who subsequently beats him up. Wozzeck goes mad, stabs Marie, and drowns himself. A chilling epilogue shows Wozzeck's little son going off to view his mother's corpse. The cruelty and unconcern of man and society is the opera's major theme, catching perfectly a Kafkaesque paranoid vision of life.

In form, *Wozzeck* is similar to Debussy's *Pelléas et Mélisande*. Each of its three acts contains five terse scenes run together by continuous orchestral music. Conventional arias are replaced by declamation over a rich orchestral background. According to Berg, each scene is constructed as a purely musical form, such as sonata, suite, fugue, and invention. In this respect, *Wozzeck* marks an extreme development in the intellectualization of opera. Its unflinching dramatic force derives, however, from Berg's genius for musicodramatic effect, from his convincing musical depiction of abnormality, and from his emphatic emotionalism, notably in Marie's *Lullaby* (Act I, Scene 3) and in the great orchestral interlude between Scenes 4 and 5 in Act III.

*Wozzeck* has a mistaken and ironic reputation as the popular masterpiece of the 12-tone school of composition, of which Berg was a master. It is mistaken because the opera precedes Berg's adoption of the 12-tone technique. It is ironic because *Wozzeck* is in fact the one widely known mature composition by any composer associated with the school.

JOSEPH KERMAN  
Author of "Opera as Drama"

**WPA.** See WORK PROJECTS ADMINISTRATION.

**WRANGEL**, vräng'əl, **Count Friedrich Heinrich Ernst von** (1784-1877), Prussian field marshal. He was born in Stettin, Germany (Polish, Szczecin), on April 13, 1784. He fought in the Prussian army against Napoleon. In 1834 he was given command of a division at Münster, where he put down a demonstration by partisans of the archbishops of Cologne against the policy of the king of Prussia.

In 1848 he was commander in chief of the German federal army that drove the Danish troops from Schleswig-Holstein. Under pressure from other great powers, Prussia ended the war with the indecisive armistice of Malmö (August 26). The German people, who had strongly supported the struggle, disapproved of the settlement, and riots occurred in Berlin. Frederick William IV ordered Wrangel to surround Berlin, and on November 10 his troops entered the city. Disorder was suppressed, and the Prussian National Assembly was forbidden to meet again in Berlin.

In 1856, Wrangel was created a field marshal. In 1864, at the age of 80 and almost senile, he was given command of the Austro-Prussian troops that invaded Schleswig. When the aged marshal proved to be a poor strategist, Gen. Helmuth von Moltke was sent to act as his chief of staff and, in fact, assume his command. Wrangel was then replaced by Prince Frederick Charles.

Wrangel was retired with honors and raised to the nobility. Thereafter he served as adviser without command in the Seven Weeks' War in 1866 against Austria. In his later years he interested himself in the reorganization of the army. He died in Berlin on Nov. 1, 1877.

**WRANGEL**, vráng'əl, **Karl Gustav**, Swedish general: b. Skokloster, on Mälaren, Sweden, Dec. 13, 1613; d. Spieker, Rügen, June 25, 1676. He rose rapidly in the army to the rank of lieutenant colonel and distinguished himself in the Thirty Years' War, in the course of which he was made colonel (1636) and major general (1638). He contributed notably to the Swedish victory at Wolfenbüttel (1641) and, under Lennart Torsenson, took part in the Second Battle of Leipzig (1642).

In 1644, Wrangel was placed in command of the Swedish fleet, defeating the Danes in a battle between the islands of Fehmarn and Lolland (Laaland). Appointed field marshal of the Swedish armies in Germany in 1646, he joined forces with the French in an attempt to break the resistance of Maximilian I of Bavaria and succeeded in forcing upon the elector the Truce of Ulm (1647). With the French, Wrangel defeated the Austrians and Bavarians at Zusmarshausen (1648), but his operations during 1646-1648 have been described as a series of skillful maneuvers rather than battles. Under Charles X Gustavus, he commanded the campaigns in Poland (1655) and Denmark (1657-1659). During the 1660's he was a member of the council of regency. He returned to command the Swedish forces against Brandenburg in 1674-1675, but ill health forced him to relinquish his command before the Battle of Fehrbellin (1675). Wrangel built Skokloster Castle, 10 miles south of Uppsala, which houses one of the finest private collections of weapons in the world, and Wrangel's Palace in Stockholm.

LEIF SJÖBERG

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**WRANGEL**, vrán'gyəl, **BARON Pyotr Nikolayevich**, Russian general: b. Novo-Aleksandrovsk, Russia, Aug. 27, 1878; d. Brussels, Belgium, April 25, 1928. He was educated as a mining engineer and spent several years working in Siberia. When the Russian-Japanese War began in 1904, he joined the army and in World War I rose to the command of a cavalry corps. With the outbreak of the Bolshevik Revolution, Wrangel joined the White forces and was put in command of one of the armies in the south by Gen. Anton Denikin. After the shattering of Denikin's 1919 offensive and the retreat of the White armies to the Crimea, Wrangel was given the over-all command in April 1920.

The opening of Polish-Soviet hostilities gave Wrangel's forces new hope, as the bulk of the Red Army was transferred to the Polish front. Although a monarchist, he organized a non-monarchist government in May, attempting to avoid some of the political shortcomings of previous White regimes. He sought with some success the cooperation of non-Russian nationalities, their separatist ambitions notwithstanding, and his government promulgated a land-distribution law aimed at winning the support of the peasants.

Initial military success in the Kuban brought Wrangel's regime de facto recognition by France in August 1920. Soon after, he suffered defeat in the Kuban and turned westward, attempting a junction with the Poles. The Polish-Soviet armistice in October, however, enabled Moscow to concentrate the Red Army against Wrangel. By mid-November 1920 the Perekop Isthmus was

breached and the Crimea cleared of White forces. The French Navy helped to evacuate 147,000 refugees, including 40,000 survivors of Wrangel's army, to Constantinople (Istanbul). Wrangel maintained a staff in Yugoslavia until 1925, attempting to organize the settlement of his soldiers. He spent his remaining years as an engineer in Belgium. *The Memoirs of General Wrangel* was published in English translation in 1929 and, as *Always with Honour*, in 1958.

ALBERT RESIS

*Northern Illinois University*

**WRANGEL ISLAND**, rāng'gəl (Russ. **OSTROV VRANGEL'YA**), island, USSR, in the Russian SFSR, attached for administrative purposes to the Chukchi National Okrug in Khabarovsk Krai. The island, about 100 miles long and up to about 40 miles wide, with an area of 1,740 square miles, is situated in the Arctic Ocean between the Chukchi and East Siberian seas, at latitude 71° N, longitude 180° E. It is separated from northeastern Siberia, to which it is related geographically, by the 83-mile-wide Long (De Long) Strait. Wrangel Island is dominated by two east-west mountain ranges that occupy the center and south of the area and end at the sea in tall headlands. The highest point is Gora Sovetskaya, which reaches over 3,000 feet. The Academy Tundra, a featureless, marshy lowland, occupies the northern third of the island. There are no glaciers on Wrangel, which apparently escaped glaciation during the ice ages. The flora is a varied, preglacial type of considerable botanical interest. The climate is exceptionally bad, with low winter temperatures (February mean, -13° F) and summer temperatures that rarely rise far above freezing point because of the pack ice that is constantly present in the adjacent sea. Fog and low cloud are typical of the summer months. The island is the summer home of large numbers of ducks, geese, and gulls. Land mammals include the Arctic fox and polar bear; walruses and seals are common in the neighboring waters and have been exploited by hunters.

Rumors of land north of the Siberian mainland originated in the 17th and 18th centuries from visits of Chukchis to Wrangel Island. Baron Ferdinand Petrovich von Wrangel (q.v.) unsuccessfully sought the island in the early 1820's. The island was probably sighted for the first time in 1849 by Capt. Henry Kellett of the British Navy after he discovered Herald Island to the east. Thomas Long, an American whaling captain, approached it in 1867; the first landing was made in 1881 by Capt. Calvin L. Hooper, United States Navy, who named it New Columbia. The island remained unoccupied until 1914, when survivors of an expedition led by Vilhjalmur Stefansson lived on it for six months. Stefansson sent an expedition in 1921 to claim the island for Canada, but he received little support. In 1924 the Soviet Union notified other nations that it intended to protect its claim to the island, and in 1926 it created a permanent settlement there, populating it with Chukchis taken from the Russian mainland. The Russian claim was not officially disputed by Britain, Canada, or the United States.

J. BRIAN BIRD  
*McGill University*

**WRANGELL ISLAND**, rāng'gəl, island, Alaska, in the Alexander Archipelago in the southeast part

of the state. The island is about 30 miles long and up to 14 miles wide and rises to an elevation of over 3,300 feet in the southwest. The chief center is the town of Wrangell (pop. 1,315), on the northern tip of the island, where the Russians first made a settlement in 1811. Later, in 1834, they built Fort St. Dionysius, which was subsequently leased to the Hudson's Bay Company as a trading center. After the sale of Alaska to the United States in 1867, the town became a stop-over for the trip up the Stikine River to the Cassiar goldfields in the Yukon. Fishing is now the principal industry, along with shrimp, crab, and salmon canneries and a sawmill.

IRENE INGLE

**WRANGELL MOUNTAINS**, mountain range, Alaska, in the southeast, bounded by the Copper River on the West, the Chitina River on the south, and the St. Elias Mountains on the southeast. Of volcanic origin, they extend for about 100 miles from northwest to southeast and are about 70 miles in width. Principal peaks are Mounts Blackburn (16,523 feet), Sanford (16,208 feet), and Wrangell (14,006 feet), an active volcano.

**WRANGLER**. See CAMBRIDGE UNIVERSITY.

**WRASSE**, rās, the common name for fishes of the family Labridae. They are found in temperate and tropical seas, most frequently inshore in rock pools or around coral reefs, but also in deeper water. The group includes such well-known fishes as the tautog, cunner, hogfish, bluehead, California sheephead, and about 100 others.

Wrasses are long and solid bodied. Their strong jaw teeth are not fused into a beak as in the parrot fishes. The pharyngeal (throat) teeth are blunt and strong and are used to crush harder food. The scales are large and cycloid. Adult sizes range from 3 inches to several feet and a weight of over 40 pounds. In the United States, two well-known northern wrasses—the tautog and the cunner—are dull in color, but farther south on both coasts there are brilliantly colored representatives of the family, such as the small, bright blue and green bluehead, the red hogfish, and the rose and black California sheephead. In some genera, the male and female are unlike in color; in some also, the young differ markedly from the adults.

Wrasses feed on seaweed, small fishes, mollusks, and crustaceans. The wrasses themselves are not food fishes, although a few of them are edible. Most of them are not popular with anglers, but a few, such as the strong, fast hogfish, put up a good fight when hooked.

CHRISTOPHER W. COATES

**WRAY, John**. See RAY, JOHN.

**WREATHS**. See CROWNS AND CORONETS—*Pre-Christian Era*; HERALDRY.

**WRECKS AND WRECKAGE**, rēks, rēk'ij, in maritime history and law. In its broadest sense in this context, *wreck* means anything without an apparent owner that is floating upon, sunk in, or cast on shore by the sea. In maritime legal usage, a *wreck* is the remains of a ship stranded and abandoned on shore, while *wreckage* is any goods or property cast ashore and a *derelict* is an abandoned ship at sea. *Wrecker* was a common

term in the days of sail but is almost obsolete today. It signified one who made a living from plundering wrecks or disposing of wreckage. Such people were at times accused of luring ships ashore with false lights but such folklore and sailors' tales are not supported by documentary records. In fact, wreckers, though primarily interested in profit from wreckage, often saved the lives of shipwrecked persons, and from their activities came the lifesaving services of both Britain and the United States.

With the advent of steam power and steel construction, ships could more easily remain off a lee shore, and those stranded could often be saved by assistance of powerful tugs fitted for that purpose. Predatory wrecking off United States coasts is now prevented by law enforced by the Coast Guard, which also took over (1915) the Lifesaving Service. Legitimate wrecking is now called *salvage*. Saving of life at sea is required by law, but salvage is voluntary and a private enterprise, stimulated by maritime law assuring a salvor financial reward for his effort.

A famous wreck of modern times was the luxury cruise liner *Morro Castle* which burned off Asbury Park, N.J., on Sept. 8, 1934, and drifted ashore. The predatory instinct toward wrecks again manifested itself in the robbing of the bodies of her dead. The *Morro Castle* disaster brought about the Merchant Marine Act of 1936, which is the law of the sea for United States ships. A comparable law in Britain was enacted in 1894.

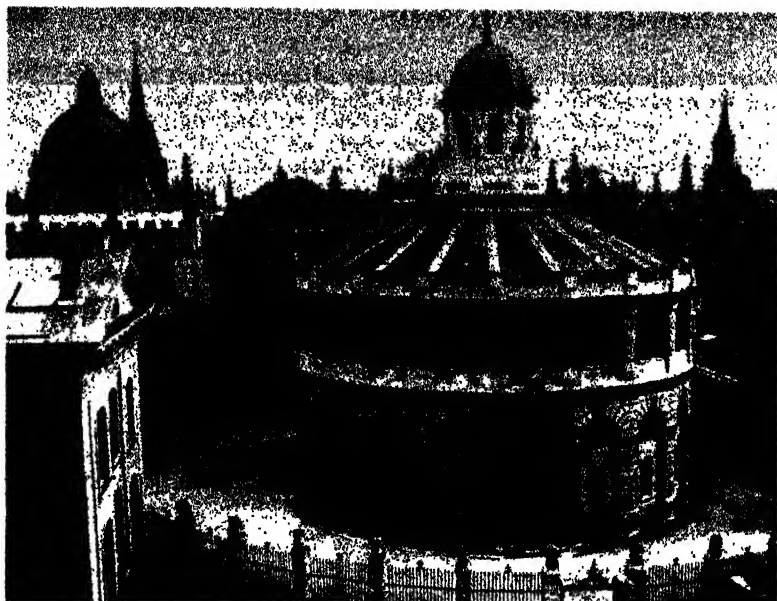
See also FLOTSAM, JETSAM, and LAGAN; SALVAGE, MARINE.

JOHN D. HAYES,

*Rear Admiral, United States Navy (Retired)*

**WREN**, rēn, Sir Christopher, English architect: b. East Knoyle, Wiltshire, England, Oct. 20, 1632; d. London, Feb. 25, 1723. He turned from a brilliant scientific career to become the most important English architect of the 17th century and, in the opinion of many, the greatest. His early life was marked by precocity in mathematics and the natural sciences and an interest in mechanical contrivance. He went to Wadham College, Oxford, at the age of 17 and, after graduating M.A. in 1653, spent three years in study and research in astronomy as a fellow at All Souls College. In 1657 he became professor of astronomy at Gresham College, London, returning to Oxford in 1661 as Savilian professor of astronomy. He resigned this post in 1673 but retained his scientific interests and his fellowship of the Royal Society of which he had been, in 1660, a founder.

**Career and Works.** In 1663 Wren made his first architectural designs—for the chapel of Pembroke College, Cambridge, and the Sheldonian Theatre at Oxford. He was also appointed that year to advise on the repair of the medieval St. Paul's Cathedral. He was a self-taught architect, and the extent of his nine-month visit to France in 1665–1666 suggests that he had by then chosen an architectural career. His choice was sealed by the Great Fire of 1666, which damaged St. Paul's irreparably and destroyed three quarters of the City of London. Although his plan for rebuilding the City, produced with great speed, was not accepted, he was appointed a commissioner for the rebuilding and, in 1669, surveyor general of works. The latter post put him in charge of all royal and government building in Great Britain.



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Sir Christopher Wren's design for the Sheldonian Theatre at Oxford was influenced by his study of 16th century Italian architecture.

Wren made or authorized designs for rebuilding 52 London churches, notably St. Bride, Fleet Street; St. Stephen, Walbrook; St. Mary-le-Bow; and St. Anne and St. Agnes. Outside the city he designed the churches of St. Clement Danes and St. James, Piccadilly. In this, the first big church-building program since the Reformation, he set the types for Protestant churches for the ensuing two centuries. He also designed, with Robert Hooke, the monument on Fish Street Hill, commemorating the Great Fire. His greatest work, the new St. Paul's Cathedral, was built in 1675–1710; building was preceded by several years of designing, and the accepted designs received continual modification, the dome and western towers being conceived after 1700.

Wren was knighted in 1673 and was president of the Royal Society in 1681–1683. He took little interest in politics but was twice a member of Parliament—in 1685–1687 for Plympton and in 1701–1702 for Weymouth—his main concern being the furtherance of St. Paul's. His long control of the Office of Works enabled him to assemble a talented team of designers, craftsmen, and administrators, but by the accession of George I in 1714 changes in taste had brought criticisms of his virtual monopoly. In that year political and artistic intrigue secured his replacement by a board of commissioners, though he retained the title of surveyor general until 1718.

No country houses can be attributed to Wren with certainty, but as the king's chief architect he designed the palaces of Winchester for Charles II, and Kensington and the rebuilding of Hampton Court for William III. Only half of Hampton Court was carried out, according to a reduced scheme. In the royal hospitals of Chelsea (for soldiers, begun 1682) and Greenwich (for seamen, begun 1696), both modeled on Louis XIV's Invalides, he was able to handle masses on a large scale. These buildings give some suggestion of the effect of his abortive scheme of 1698 for a great palace in Whitehall, London, for which designs are extant. Greenwich is partly the work of his assistants, but he was responsible for the hall and the domes and colonnades, as well as the plan. The hall (painted by Sir James Thornhill) is the finest surviving baroque inte-

rior in England, and Greenwich and Hampton Court are among the major monuments of the baroque style.

**Style.** Although he never visited Italy, Wren's earliest work was largely inspired by Italian Renaissance architecture; the culmination of this phase was the library of Trinity College, Cambridge (1676–1685). An increase in scale during the 1680's was accompanied by a greater reliance on French and Italian art of a period nearer his own time, and research since 1950 has confirmed that these stylistic changes were his own rather than due to his pupils and assistants. Wren's lifespan saw great changes, from the establishment of the pure Renaissance style introduced by Inigo Jones to its development toward a freer, more dramatic baroque and, in the last decade of his life, the rise of the simpler and deliberately limited architecture of Palladianism.

St. Paul's Cathedral, the central work in Wren's career and the monument in which he is buried, reveals all his many qualities. His mathematician's feeling for shape (which he recorded) informs the miraculously simple shape of the dome, while his appreciation of baroque plasticity is evident in the western towers; their contrast with the dome, achieved after many experimental designs, is the work of a man fully conscious of the visual impact of architecture. His structural ingenuity is seen in the complex buttressing system of the dome and the use of a brickwork cone to raise the lantern and outer dome to a telling height above the interior. Of his wide range and assured use of decorative detail and the high standard of craftsmanship he encouraged, every part of the building is evidence.

See also LONDON; SAINT PAUL'S CATHEDRAL.  
KERRY DOWNES

*Honorary Lecturer in Fine Arts  
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**WREN**, a small songbird of the family Troglodytidae. The family is well defined and homogeneous, consisting of about 60 species restricted to the New World except for a single species that inhabits Eurasia as well as North America. This species, *Troglodytes troglodytes*, called simply "wren" in England, is known as the winter wren in North America. It is the subject of a very rich folklore in Europe.



AUSTING AND KOEHLER FROM THE NATIONAL AUDUBON SOCIETY

A house wren perches at the entrance to its nesting box. House wrens range from southern Canada to Argentina.

Wrens are plain, solitary little birds that sing loudly and can scarcely be mistaken for any other bird. They vary in size from 4 to 9 inches (10–23 cm), most of them averaging less than 6 inches (15 cm), and are brown or grayish, more or less speckled with white. The bill is slender, usually fairly long and slightly decurved, the legs are long, and the wings are very short and rounded. The tail is typically short and stubby and is carried cocked upward at a sharp angle. The song, usually liquid and very musical, carries far and is given with great abandon, the whole creature quivering with the effort. In some wrens, however, such as the cactus wren (*Campylorhynchus brunneicapillus*), which inhabits the deserts or very arid regions of the United States and Mexico, the song is a jumble of harsh and grating notes.

Wrens are usually found on or near the ground, feeding chiefly on insects and spiders. They build globular nests with a side entrance. The building is done by the male, which makes several nests before the female selects one, usually better constructed and better concealed than the others, in which to raise the family. This habit is not understood, but the "dummy" nests are used for sleeping, and it is believed that they may also delude predators. The familiar house wren (*T. aedon*) of the United States, which frequents the vicinity of human dwellings, seems, however, to prefer a hole about a building or any suitable nesting boxes that are offered.

CHARLES VAURIE

Former Curator, Department of Ornithology  
The American Museum of Natural History

**WRESTLING**, res'ling, a sport in which two opponents grapple for supremacy according to prescribed rules. Originating in antiquity, wrestling is the oldest and most basic form of recreational combat. Modern amateur wrestling is essentially a refinement of ancient techniques.

**Styles and Classes.** Modern Olympic and world amateur championships are conducted in two styles: freestyle and Greco-Roman. There are 10 weight classes, ranging from 48 kilograms (105.5 pounds) to 100 kg (220 lbs), plus heavyweight. In 1985 an upper limit was set for the heavyweight class: no contestant may weigh more than 130 kg (286 lbs). All international competition is governed by the Fédération Internationale de Lutte, or the International Amateur Wrestling Federation (FILA).

**Freestyle.** Of the international wrestling styles, freestyle is the most popular in the United States, because it closely resembles the folkstyle practiced in scholastic and collegiate programs. In freestyle, a wrestler may attack his opponent's legs, as with single-leg or double-leg tackles, or he may apply other holds below the waist, such as the fireman's carry or the crotch lift. He also may use his own legs to attack, as with trips and some types of scissors holds. The defensive wrestler may also use his legs to counterattack or to block certain lifts.

Points are scored in freestyle for takedowns (1), reversals (1), and near falls (2). A near fall, or tilt, is scored by turning an opponent's back to the mat at an angle of less than 90 degrees, or by touching both his shoulders to the mat for an instant. If both shoulders are held to the mat for one-half second, it is ruled a fall and the match is over. If, from a standing position, a wrestler throws his opponent directly into a near fall, the action is worth 3 points. Such a maneuver performed with a spectacular high-arching throw is awarded 4 points.

**Greco-Roman.** The rules for Greco-Roman wrestling are identical to those for freestyle, with one exception: the legs may not be used in attack or defense. That limitation, however, occasions significant differences in philosophy and style. Much of the scoring results from spectacular arching throws, inasmuch as a defensive wrestler being lifted may resist only by shifting his weight and balance and not by blocking with his legs or by grasping his opponent's legs.

**Sombo** A third international style, *sombo* has not yet been accepted as an Olympic sport, although world championships have been conducted. The name *sombo* is derived from a Russian acronym standing for "self-defense without weapons." A blend of wrestling and judo, it draws rules and participants from both. *Sombo* may come to be recognized as a separate sport.

**The Wrestling Match—Area, Equipment, and Officials.** Today's wrestling mat is 4 to 6 centimeters (about 2 inches) thick and made of a foam-core plastic with a smooth bonded cover. The center wrestling area is 7 meters (23 feet) in diameter and is surrounded by a 1-meter band called the "passivity zone."

Each wrestler is attired in a one-piece uniform called a singlet, one wearing red and the other blue, and ankle-high shoes without heels. Light kneepads are permitted, but additions such as headgear or T-shirts are not.

Three officials—a referee, a judge, and a mat chairman—direct the bouts. At least two officials must agree on any decision.



**The Bout.** Each bout consists of two 3-minute periods, a total of 6 minutes of actual competition. During the one-minute interval between periods, each wrestler may be assisted by a coach and masseur. Each period starts with the wrestlers on their feet facing each other 1 meter apart. If the wrestlers step into the "passivity zone" with no action in progress, they are returned to the center for a fresh start.

The 6-minute bout can be cut short by a fall, by one wrestler opening a lead of 12 or more points over his opponent, or by disqualification for passivity, illegal holds, or misconduct.

A fall occurs when a wrestler's shoulders are pinned to the mat for one-half second. The winner of a full 6-minute bout is determined by points awarded for successful execution of specific maneuvers, such as takedowns (bringing the opponent to the mat from a standing position), reversals (exchanges of control), near falls (turning the opponent's shoulders toward the mat at an angle of less than 90 degrees), and a variety of throws to the mat.

Once a wrestler has taken his opponent to the mat, he is given the opportunity to continue in "par terre" position (on the ground) and to attempt to turn his opponent's shoulders into a "danger" position—past 90 degrees. If the officials believe that he will not succeed quickly, both wrestlers are returned to the standing position. No points are scored merely for controlling an opponent.

The rules strictly forbid tactics intended to injure the opponent, such as hair-pulling, scratching, grabbing the throat, twisting the fingers or any joints, or driving a knee or elbow into the opponent's back or abdomen.

**Total Wrestling.** Through the efforts of FILA President Milan Ercegan of Yugoslavia, the concept of "total wrestling" has become the guideline for international competition. The bout was shortened from 9 to 6 minutes, but constant aggressive activity is required or the passive wrestler is penalized and perhaps disqualified. The element of "risk" is the keynote of the new philosophy: the wrestler must take risks to score, particularly if his opponent is ahead on points.

**Wrestling in the United States.** The rules for collegiate and scholastic wrestling in the United States vary sharply from those of international freestyle, placing emphasis on control of the opponent rather than on physical dominance. A fall must be held for one second (collegiate) or two seconds (scholastic). Requirements for near-fall points are much more demanding. Points are awarded for takedowns and reversals, but spectacular throws are prohibited. Escaping from an opponent is a scoring maneuver, and merely controlling him can earn a point for time advantage. As in international wrestling, the rules of the National Collegiate Athletic Association and the National Federation of State High School Associations strictly forbid brutality and place special emphasis on the physical safety of the wrestlers.

The national governing body and international delegate for the sport is USA Wrestling, which conducts national championships each year in both freestyle and Greco-Roman. As part of its responsibilities for promotion of the sport, USA Wrestling conducts an extensive series of clinics in coaching, officiating, and sports medicine, and produces books, films, and videotapes. As many as 70 regional and national tournaments are con-

ducted annually for various age groups, starting as young as 9.

All such competition is under international rules, subject to modifications adopted for the health and safety of young wrestlers. Some of these events determine the lineups of United States teams competing against the national teams of other countries.

The offices of USA Wrestling are housed in the National Wrestling Hall of Fame and Museum in Stillwater, Oklahoma.

**Famous Amateur Wrestlers.** Because of the intense popularity of collegiate wrestling, most of the 20th century heroes of the sport are recognized largely for their undergraduate achievements. Dan Gable, for example, is better known for his 100 victories as a collegiate wrestler at Iowa State University and his 100-plus wins as coach at the University of Iowa than he is for his Olympic gold medal in 1972 or his role as Olympic freestyle coach in 1984.

Other "giants" of the sport in the United States include Robin Reed of Oregon State, a 1924 Olympic gold medalist at 134 pounds, who never lost a match to any opponent of any size; skilled technicians such as Stanley Henson, of Oklahoma State in the late 1930's and Bill Koll of Northern Iowa in the 1940's; Danny Hodge of Oklahoma, an athlete of incredible strength who pinned almost all of his opponents, in the 1950's; and Henry Wittenberg, a New York policeman, who won more than 300 matches in a row and collected gold and silver medals in the 1948 and 1952 Olympics.

The "first family" of American wrestling is that of Rex Peery, who won three national collegiate championships at Oklahoma State (1933-1935) and then coached his sons Hugh and Ed to three titles each at the University of Pittsburgh in the 1950's.

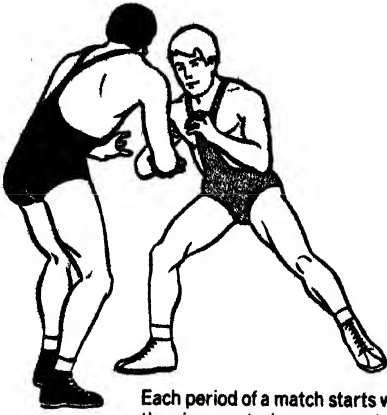
**Professional Wrestling.** In the early decades of the 20th century, professional wrestling was popular in the United States, reaching its peak in the 1920's and 1930's. It has since degenerated into a prearranged display of rough-and-tumble acting, with designated "heroes" and "villains," and no longer is considered a competitive sport.

**Folklore Styles.** More than 160 traditional or "folklore" variations of wrestling are recognized by the FILA. In the Soviet Union, championships and exhibitions of folklore wrestling are held, such as *tchidaoba* from Georgia, *kokh* from Armenia, *gulech* from Azerbaidzhan, *kurach* from Uzbek, and *kurek* from Kazakhstan. In Britain, styles were developed that took the names of their districts of origin: Cumberland, Westmoreland, Cornwall, and Lancashire. In the Cumberland style, if the starting hold is lost or if any part of the body except the feet touches the ground, the contestant loses. In the Cornwall and Devon style, the match begins from the upright position, and ground wrestling is prohibited. In Germany, wrestling holds and maneuvers were entirely on the ground.

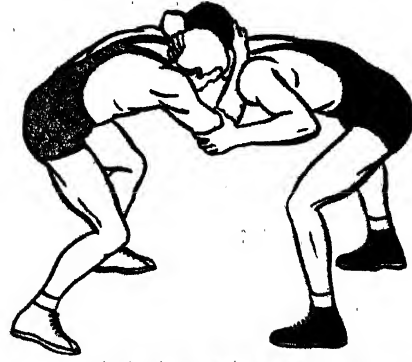
In Switzerland the popular style known as *schwingen* features special pants and a strong belt that the wrestlers grip at the start of a match. In *glima*, popular in Iceland, the wrestlers are equipped with belts for grasping. Similar styles prevail in Syria and some parts of the Soviet Union.

Wrestling has been popular in the Orient for at least 2,000 years. In the Japanese *sumo*, perhaps

## BASIC WRESTLING HOLDS



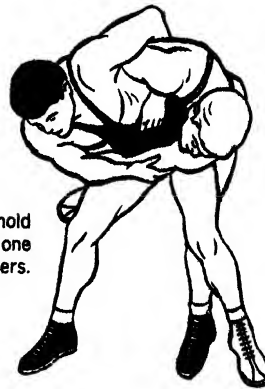
Each period of a match starts with the wrestlers in a neutral, or on-guard, position with hands held palms-down in front of hips.



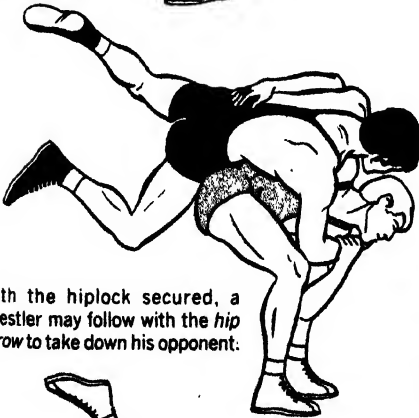
In the *tie-up*, wrestlers vie from the standing position to secure a grip for advantage in forcing the opponent to the mat.



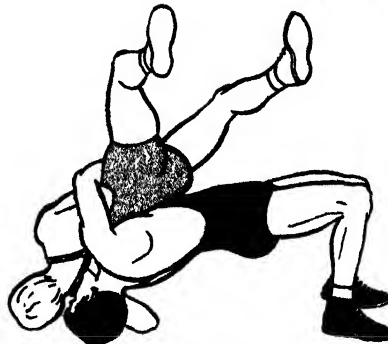
A legal *headlock*, which must include an arm as well as the head, could result in an immediate fall.



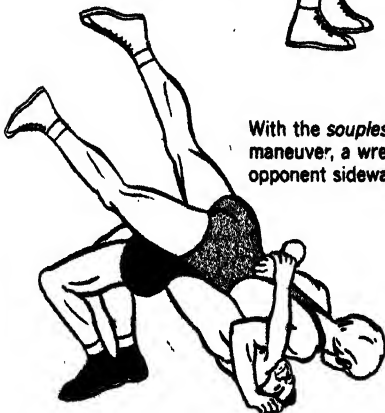
The *hiplock*, a standard hold for advantage, may result in one of several forcing maneuvers.



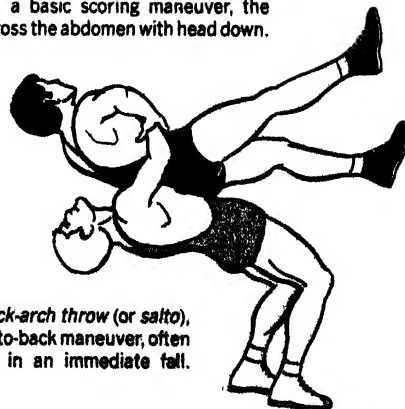
With the hiplock secured, a wrestler may follow with the *hip throw* to take down his opponent.



In the *gut wrench*, a basic scoring maneuver, the opponent is held across the abdomen with head down.



With the *souplesse*, a belly-to-belly maneuver, a wrestler may turn his opponent sideways or on the back.



The *back-arch throw* (or *salto*), a belly-to-back maneuver, often results in an immediate fall.

the best known and most stylized of folklore wrestling, the winner is determined when the opponent is thrown to the ground or forced outside the boundaries of the mat. *Sumo* has no weight classes, and most contestants tip the scale at 300 to 400 pounds (136–181 kg).

**History.** Carvings and drawings 15,000 to 20,000 years old, found in caves in France, illustrate wrestlers in hold and leverage positions. Sumerian wrestlers were cast in bold relief on stone slabs at least 5,000 years ago. A bronze statuette of wrestlers, dated 2600 B.C., was unearthed in the ruins of Khajafi, near Baghdad.

In Egypt, paintings of wrestlers dating from about 2500 B.C. were found in tombs of kings and officials. In the tomb of the vizier Ptah-hotep six different wrestling holds are shown. The hundreds of drawings in the temple-tombs of Beni Hasan demonstrate that most holds in use today were performed in ancient Egypt. The maneuvers depicted are more closely related to the present-day sport than are those of such modern forms as *sumo*, *kohk*, and *glima*, for example.

The Greek poet Homer described wrestling matches, and the sport became the final and decisive event of the pentathlon at the public games. The poet Pindar describes how the gods Zeus and Cronus wrestled for possession of the universe along the river Alpheus at Olympia. Zeus was victorious, and the first Olympic festival was held in 776 B.C. to commemorate his triumph. In the 18th Olympiad, in 708 B.C., wrestling was introduced as a major sport. The philosopher Plato as a young man won many prizes for wrestling. His real name was Aristocles, but because of his success he was given the name Plato, meaning "broad shoulders."

After the conquest of the Greek Empire by the Romans, the sport degenerated into violent gladiatorial contests, in which the loser often did not survive. As the Roman Empire expanded, the contests spread across Europe. The "catch-as-catch-can" style, the forerunner of modern freestyle, developed: no holds were barred on any part of the combatants or their garments. In Europe during the Middle Ages, wrestling was considered a knightly skill. In 1520 at the Field of the Cloth of Gold, Henry VIII of England and Francis I of France watched wrestling matches between their countrymen. Henry challenged Francis and reportedly was thrown by him.

During the Napoleonic era, in the early 19th century, the French developed a style identified today as Greco-Roman: holds on or with the legs, and tripping, were prohibited.

In both North and South America, Indians engaged in wrestling bouts long before Columbus set foot in the New World. Among American presidents, George Washington, Abraham Lincoln, and William Howard Taft were skilled wrestlers.

See also JUDO; JIJITSU; MARTIAL ARTS.

ROBERT E. DELLINGER, *Director and Member*  
*National Wrestling Hall of Fame*

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**WREXHAM**, rek'səm, a town and market center in Wales, in Clwyd county, 10 miles (16 km) southwest of Chester, England. Its industries include coal mining, leatherworking and tanning, brewing, and the production of chemicals, synthetic fibers, and plastics.

St. Giles Church, whose present structure dates from the 15th and 16th centuries, is renowned for its Gothic tower, one of the traditional "seven wonders of Wales." In the churchyard is the grave of Elihu Yale, the early benefactor of the American university that bears his name. Population:(1981) 40,272.

**WRIGHT, Frances** (1795–1852), British-American social critic, who was active in the causes of women's rights, education, and reform in early 19th century America. Frances (Fanny) Wright was born in Dundee, Scotland, on Sept. 6, 1795. Her parents died when she was two years old, and she became heir to a substantial fortune. She first visited the United States in 1818–1820, and in 1821 published an enthusiastic book, *Views of Society and Manners in America*. Contradicting the disparaging accounts of most foreign tourists, the book interested European intellectuals. Wright formed a close friendship with the Marquis de Lafayette. She and her sister Camilla joined him in his triumphal tour of the United States in 1824–1825.

Fanny Wright thereafter determined to work at solving the problem of black slavery in the United States. She bought a few slaves and 2,000 acres (80 hectares) of woodland, which she called Nashoba, in western Tennessee. She was not an abolitionist, but she hoped to demonstrate that slaves by their labor could buy their freedom and finance their colonization outside the United States while their children were being schooled for freedom. Her *Plan for the Gradual Abolition of Slavery* (1825) won the approval of Thomas Jefferson and James Madison, but before it could be put into practice, Fanny Wright met Robert Owen and his son Robert Dale Owen. Impressed by their socialist utopia in New Harmony, Ind., she resolved to make Nashoba a cooperative community. One of her radical recruits published a report that Nashoba advocated free love and racial interbreeding. The scandal had little basis, but it killed Nashoba.

Fanny Wright eventually settled her slaves in Haiti. Meanwhile, she had become America's first woman lecturer. Tall and strikingly handsome, with a voice of singular power, she denounced the influence of the church in politics and demanded rights for women and workingmen. With Robert Dale Owen she edited the *Free Enquirer* in New York City (1829–1830), which opposed imprisonment for debt and proposed free public education and birth control. For a woman to make public her views on birth control was considered unforgivable. Although mobs threatened her and the newspapers attacked her, the "Fanny Wrighters" polled 6,000 votes in the New York election of 1829.

In 1831, Fanny Wright married William Phikepal D'Arusmont. Her return to lecturing in 1835 led to the breakup of her marriage. She died in Cincinnati, Ohio, on Dec. 13, 1852.

HELEN BEAL WOODWARD\*, *Author, "Bold Women"*

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Unity Temple (above), in Oak Park, Ill., is an outstanding example of the early work of Frank Lloyd Wright. The architect designed his winter home, Taliesin West (right), to conform with the rugged beauty of its Arizona setting.



PHOTOS BY HEDRICH BLESSING

**WRIGHT, Frank Lloyd** (1867–1959), American architect, considered by some to be the greatest American architect of all time and one of the world's greatest. During his 70-year professional career, he made important contributions to the modern movement in architecture. A great designer, he was also a dedicated innovator, theoretician, and teacher. And he left his mark on his times in a way that is unmatched by any of his architect contemporaries.

**Life.** Wright was born in Richland Center, Wis., on June 8, 1867. His father deserted the family when Wright was 16. His mother was a strong and willful woman, who had decided before he was born that he would become an architect. When he was a young child his mother gave him paper, blocks, and other simple materials, which he would arrange, with her help, into shapes resembling rudimentary furniture and buildings. He later maintained that this training deeply affected his architecture.

At 18, Wright enrolled in the engineering school of the University of Wisconsin but dropped out after less than two years. He went to work for James Lyman Silsbee, a Chicago architect, but only stayed a few months. He then found a job with Adler and Sullivan in Chi-

cago and thus came under the influence of Louis Henri Sullivan, now acknowledged as the first modern American architect. Sullivan summed up his architectural philosophy as "form follows function," by which he meant that the design of buildings should derive from their uses. This was a radical idea at the time, but one that Wright readily accepted from the man whom he would ever after call "Master." Wright stayed there about five years first as a draftsman and later as a designer. He worked on several of the great Sullivan buildings and designed the Charnley House (1891), in Chicago, for the firm. In 1889, Wright designed his own house in Oak Park, Ill. His earliest commissions were for houses, which he moonlighted while working for Adler and Sullivan.

In 1893 he left the firm to start his own practice, first in Chicago and later in Oak Park. After leaving his family for another woman, Wright went to Europe for a year. Upon his return he went to Spring Green, Wis., where he had inherited his family's farm. There, in 1911, he built his famous house, Taliesin. In 1915, Wright designed the Imperial Hotel in Tokyo and during its construction spent most of his time in Japan until 1922.

After a series of personal and professional misfortunes, Wright was declared bankrupt in 1928 and all of his possessions were sold. During the Great Depression, Wright designed a number of buildings, but none were constructed. He supported himself mostly by lecturing and writing. In 1932 he established the Taliesin Fellowship, a combination of architectural schooling and apprenticeship. Students who admired Wright's work went to Taliesin to learn from him; many of them never escaped his influence during their later professional years.

During the later 1930's, Wright received a number of commissions for buildings of various types. He also began to receive considerable recognition, in Europe rather than in his native country, for his architectural designs. In 1937, Wright began to plan Taliesin West, in Scottsdale, Ariz., which became his winter home and studio. Architectural commissions were again scarce during World War II. Wright designed a few buildings, but almost none were constructed. After the war, commissions came in rapidly. His talents renewed, he produced a number of fine works. By the end of his career, he had designed more than 400 buildings. Much honored and admired for his accomplishments, he died in Phoenix, Ariz., on April 9, 1959.

**Work.** Wright lived so long and was so creative that it is useful to divide his professional life into three phases: an early period (1893–1910), a mature period (1910–1945), and a later period (1945–1959).

**Early Period.** During the early years of his practice, Wright designed mostly houses and apartment buildings in Chicago and Oak Park, Ill., and nearby towns. These buildings were not really indicative of the path on which his talents would take him later. Although well designed and detailed, they were very much like buildings by many academic architects of the time. However, his Willits House (1902) in Highland Park, Ill., was a giant step forward. It contains virtually the first suggestion of his later designs—open interiors and long, low exteriors, with hipped roofs and wide overhangs—in what came to be known as the "Prairie Style." Notable examples in this style were the Heurtley House (1902), Oak Park, and the Martin House (1904), Buffalo, N.Y.

Then Wright designed what many consider his first masterpiece, the Larkin Company Administration Building (1904), in Buffalo. It was noted not only for its architectural form and detailing, but for its great interior atrium, often used in buildings today but an oddity then, and for its early use of plate glass and air conditioning. The building was demolished in 1950.

Other masterpieces soon followed, including Unity Temple (1907) in Oak Park and the Robie House (1909) in Chicago, usually considered Wright's finest Prairie Style house. Another structure of importance is the Coonley House (1909), River Forest, Ill.

**Mature Period.** Wright started this period with the design of his own house, Taliesin (1911), in Spring Green. Other fine houses followed. He then designed a very large project, the Midway Gardens (1914), a great decorative indoor-outdoor amusement center in Chicago. It was demolished in 1929. Taliesin burned and was rebuilt in 1915. For more than six years, beginning in 1916, the Imperial Hotel (1922), in To-

kyo, Japan, absorbed much of his energies. After surviving earthquakes and other problems, the building was demolished in 1968.

Wright also designed several significant houses in the United States, some of them in experimental custom-designed concrete block, a material usually considered then and now as among the most mundane. Notable examples include the Barnsdall House (1920), in Los Angeles; the Millard House (1923), in Pasadena, Calif.; and the Freeman House and Ennis House, both in Los Angeles, completed in 1924.

Taliesin again burned in 1925 and Wright rebuilt it again, in considerably altered form. During the Depression, Wright had little work. In 1937 he designed "Fallingwater," the Edgar Kaufmann House, near Bear Run, Pa. With its daring structure cantilevered over a waterfall, this house has been called the very finest of Wright's many designs.

During this period Wright designed a new style of house, which he called the "Usonian," that was as radical as his earlier Prairie houses had been. These new houses were usually relatively small and compact and utilized a modular system, far ahead of its time. They had other modern features, such as concrete slab floors incorporating pipes for hot-water heating and wood sandwich-panel walls, assembled at the site and then placed into position in the houses. Over the years, he designed a number of these houses, each incorporating new improvements.

Then came two masterpieces, Taliesin West, still being remodeled at the time of his death, and the Johnson Wax Company Administration Building (1939) in Racine, Wis. In 1938, Wright designed the master plan, his first, for Florida Southern College, Lakeland, Fla. The first building was completed that same year and nine others followed, the last completed in 1954. Wright designed a number of houses during the late 1930's and a few during the World War II years. In 1943 he designed the outstanding Guggenheim Museum in New York City, but more than 15 years passed before it was built.

**Later Period.** After World War II, Wright, at 78, entered an era of great activity. One commission produced another masterpiece, the Johnson Wax Company Laboratory Tower (1949). Other notable buildings during these years include the Unitarian Church (1947), Madison, Wis., and the Price Company Tower (1953), his first and only high-rise office building, in Bartlesville, Okla. In 1956, at last, construction began on his Guggenheim Museum; also under construction were his Beth Shalom Synagogue, Elkins Park, Pa., and the Kalita Humphreys Theater, Dallas. All were completed in 1959, the year Wright died.

A number of Wright-designed houses and other buildings were constructed following his death, with necessary architectural services performed by his successors, Taliesin Associated Architects. The last major building was the Marin County Civic Center (1962), in San Rafael, Calif.

See Index entry *Wright, Frank Lloyd* for other illustrations of his work.

WILLIAM DUDLEY HUNT, JR., *Author of*  
*"Encyclopedia of American Architecture"*

**Further Reading:** Brooks, H. Allen, ed., *Writings on Wright* (MIT Press 1981); Jacobs, Herbert, and Jacobs, Katherine, *Building with Frank Lloyd Wright* (Southern Ill. Univ. Press 1986); Wright, Frank Lloyd, *An Autobiography* (1943; reprint, Horizon Press 1977).



**WRIGHT, Harold Bell** (1872–1944), American novelist. He was born in Rome, N.Y., on May 4, 1872. Successively a house painter, a landscape painter, and a pastor, he turned to writing fiction while serving a Pittsburg, Kans., church. He published his first novel, *That Printer of Udell's*, in 1903. Of his 18 other novels, the most popular were *The Shepherd of the Hills* (1907), *The Calling of Dan Matthews* (1909), and *The Winning of Barbara Worth* (1911). Wright died in La Jolla, Calif., on May 24, 1944.

His stories, which are estimated to have sold over 10 million copies, chiefly concern love and adventure in the Southwest. They are moralistic and sentimental, but his treatment of local color and background is excellent.

**WRIGHT, Henry** (1878–1936), American landscape architect and city planner. He was born in Lawrence, Kans., on July 2, 1878. After studying architecture at the University of Pennsylvania, he assisted in the landscaping for the Louisiana Purchase Exposition in St. Louis in 1904 and designed parks and boulevards in many Midwestern cities. Among the numerous community plans on which he worked were Sunnyside Gardens in Queens (New York City), the renowned Radburn project in the borough of Fair Lawn, N.J., and Chatham Village, in Pittsburgh, Pa. As the planning director of the New York State Housing and Regional Planning Commission, he laid the groundwork for a classic report, *A Plan for the State of New York* (1926).

The most important of his many innovations was the superblock with an internal park at its core. Wright pioneered in housing cost accountability and was a major force in the advancement of city planning education. He died in Newton, N.J., on July 9, 1936.

**WRIGHT, James Arlington** (1927–1980), American poet, who won the Pulitzer Prize in 1972 for *Collected Poems*. He was born in Martins Ferry, Ohio, on Dec. 13, 1927. After four years in the U.S. Army, he studied under John Crowe Ransom at Kenyon College and Theodore Roethke at the University of Washington (Ph.D., 1959). He later taught at the University of Minnesota, Macalester College, and Hunter College. He died in the Bronx, N.Y., on March 25, 1980.

Wright's first books of poetry were *The Green Wall* (1957) and *Saint Judas* (1959), both influenced by Edwin Arlington Robinson. He then became associated with the experimental poets Robert Bly and William Duffy. He made verse translations of such poets as Pablo Neruda, Georg Trakl, and César Vallejo. Wright's later volumes include *The Branch That Will Not Break* (1963), *Shall We Gather at the River* (1968), *Two Citizens* (1973), *The Blossoming Pear Tree* (1977), and *The Journey* (1982).

**WRIGHT, James Claude, Jr.** (1922– ), American political leader, who served as Speaker of the U.S. House of Representatives. Wright was born in Fort Worth, Texas, on Dec. 22, 1922. After studying at Weatherford College and the University of Texas, he served in the Army Air Force during World War II. Entering politics as a Democrat, Wright was elected in 1946 to the Texas House of Representatives, but his support of civil-rights bills cost him reelection.

Wright won a seat in the U.S. House from the Fort Worth area in 1954 and was regularly reelec-

ted every two years thereafter, though he failed in Senate bids in 1961 and 1966. Wright was a liberal on economic issues. Although he opposed the Civil Rights Act of 1964, he supported most subsequent civil-rights bills. He backed U.S. policy in Vietnam.

A skilled and tenacious legislator, Wright was elected Democratic majority leader of the House in 1976. He succeeded Thomas P. O'Neill, Jr., as Speaker in 1986. He was considered a very effective Speaker and compiled an impressive legislative record. But in May 1988 complaints were filed with the House ethics committee charging that Wright had attempted to circumvent House rules on outside earnings by arranging for unusually high royalties on a book he had written and by improperly accepting gifts from a Fort Worth developer. Wright denied that he had knowingly broken House rules. After a lengthy investigation, in the course of which his political position was badly eroded, Wright resigned from the speakership in May 1989 and from the House itself in June of that year.

**WRIGHT, Orville.** See WRIGHT, WILBUR AND ORVILLE.

**WRIGHT, Richard Nathaniel** (1908–1960), American writer. He was born near Natchez, Miss., on Sept. 4, 1908. During his childhood he suffered from poverty and parental neglect, and at the age of 15 he began to shift for himself in Memphis, Tenn. Here he developed an interest in reading that awakened a desire to become a writer. After roaming about the country for a few years, he went to Chicago in 1934, began to identify himself with Communist activities, and found employment with the WPA Federal Writers' Project, moving to New York in 1937. After World War II he lived in Paris, France, where he died on Nov. 28, 1960.

Wright's first book, *Uncle Tom's Children: Four Novellas* (1938; reissued in 1940 with a fifth story), depicts melodramatic, highly emotional scenes of violence and injustice arising from conflicts between whites and blacks in the South. A Guggenheim fellowship enabled him to complete a full-length novel, *Native Son* (1940), which was universally acclaimed. It is a tense and moving study of a young Chicago black convicted of murder, sympathetically portrayed as a victim of social and economic injustice. In *Black Boy* (1945), a distinguished autobiographical novel about his own unhappy childhood and teenage years in the South, Wright reached the height of his literary powers.

Later novels and short stories were less successful. *The Outsider* (1953) draws upon his experiences as a Communist before he denounced the party and discontinued his membership in 1944. *The Long Dream* (1958) deals with racial prejudice in the South. *Eight Men* (1961) is a collection of short stories. His nonfiction is that of a deeply subjective reporter: *Twelve Million Black Voices* (1941), a short illustrated history of the blacks; *Black Power* (1954), an account of his visit in 1953 to the Gold Coast (now Ghana); *The Color Curtain* (1956), a report of the Asian-African conference at Bandung in 1955; *Pagan Spain* (1957), personal observations; and *White Man, Listen!* (1957), lectures on the international race issue. His fame rests upon his championing of the black cause, chiefly through his skill as a novelist. His writing may be said

to contain more anger than art, but despite some unevenness of style he sustained in his works a narrative power and a disturbing emotional impact that brought him lasting recognition.

WILLIAM BRACY, *Beaver College*

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**WRIGHT, Silas**, American political leader: b. Amherst, Mass., May 24, 1795; d. Canton, N.Y., Aug. 27, 1847. He graduated from Middlebury College, was admitted to the bar in 1819, and began practicing in Canton. From 1824 to 1827 he was in the New York State Senate, where he became a leader of the Bucktail Democrats (opposed to DeWitt Clinton) and a member of the Albany Regency group. (See ALBANY REGENCY; BUCKTAILS.) In 1827 he went to the House of Representatives in Washington, where he favored protection and helped frame the 1828 "tariff" of abominations" (which later, in 1842, he admitted was "a great error"). He resigned his House seat in 1829 to become comptroller of New York State and resigned this office in turn in 1833 to complete the term of William L. Marcy (who had been elected governor of New York) in the United States Senate. Reelected senator in 1837 and 1843, Wright was held in high esteem by his colleagues. He was a logical and powerful reasoner, of unflinching integrity, and ready to sacrifice his inclinations to the needs of the Democratic Party. His contemporaries referred to him as "the Cato of the Senate" and "the Cato of the Union," and Arthur M. Schlesinger characterized him as "a preliminary sketch for Abraham Lincoln."

As senator, Wright opposed rechartering the Bank of the United States, urged an independent treasury system, and saw the bill for the latter passed in 1840. Refusing President John Tyler's offer of an appointment to the United States Supreme Court in 1844 and the nomination for vice president on the Democratic ticket in the same year, he resigned his seat in the Senate to run for governor of New York, winning the election and carrying the state for the Democratic presidential candidate, James K. Polk. As governor Wright alienated the landlord interests by advocating rent reform but also lost popular support by suppressing the antirent disturbances. He was renominated in 1846 but lost to his Whig opponent, John Young.

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**WRIGHT, Wilbur**, b. Millville, Ind., April 16, 1867; d. Dayton, Ohio, May 30, 1912; and **Orville**, b. Dayton, Ohio, Aug. 19, 1871; d. there, Jan. 30, 1948; American inventors. Their father, Milton Wright, was a bishop of the Church of the United Brethren in Christ. Though both brothers completed high school courses, neither graduated formally; Wilbur did not return from Dayton to Richmond, Ind., where the family had been living, to receive his diploma, and Orville, in his final year, took a special course. Neither Wilbur nor Orville ever married. As a youth Orville became interested in printing and in 1889 started the *West Side News*, in which Wilbur joined him; it was printed on a homemade press. In 1893 the two brothers opened a shop for the sale, repair, and manufacture of bicycles.

**First Glider Experiments.** After the death (1896) of Otto Lilienthal, the German engineer, news of

whose gliding experiments Wilbur and Orville had followed eagerly, they thought of taking up gliding where Lilienthal had left off. Their interest in aerodynamics had been aroused in childhood by a toy helicopter powered by rubber bands. Finding few books on the subject in the Dayton Public Library, they wrote in 1899 to the Smithsonian Institution at Washington for a bibliography. Books they then read included Lilienthal's *The Problem of Flying* and *Practical Experiments in Soaring*; and *Progress in Flying Machines*, by Octave Chanute, the best historian of attempts to fly. Wilbur came to know Chanute, at first by correspondence, and for years the brothers kept him informed of their progress.

Orville thought a flying machine should be under better control than any yet tried, and that for sideways balance there should be a way to present the right and left wings at different angles to the wind; Wilbur hit on a practical way to do this, by twisting or warping the wings. To test this method, they built, in July 1899, a small kitelike glider with superposed surfaces, each 5 feet from tip to tip. It showed that their system of control was effective, and they then planned a man-carrying glider.

From United States Weather Bureau wind records they found that Kitty Hawk, N.C., was one of the breeziest places in the country; they also learned that the area had sand hills, free of growth and suitable for gliding. They went there in 1900 with their first man-carrying glider, which was 18 feet from tip to tip. It included a feature not on any previous glider, a horizontal front rudder or elevator about 4 feet in front of the lower main plane; the rear edge could be raised or lowered for fore-and-aft balance. A cradle, in which the operator lay, was connected with wires in order to give a spiral twist to the wings; a movement of the body of 2 or 3 inches from one side to another was enough to give all the twist needed. It was the brothers' intention to fly the glider as a kite, with a pilot aboard, to gain practice, but they found this possible only when the wind was at least 25 miles an hour. The glider failed to perform in lifting as had been calculated from the Lilienthal tables of air pressure, but they were encouraged by the way their method of control worked. Before leaving camp for the year, they took the machine to Kill Devil Hill near Kitty Hawk and made about a dozen glides down the side of the hill. Disappointed with the glider's lifting ability, they determined to return the next year with a larger machine having wings of deeper curvature.

**Further Research** Since the results obtained did not at all agree with the estimated values computed from Lilienthal's tables and other accepted tables of air pressure, the brothers wondered if Lilienthal's figures and all scientific books on the subject could be wrong. Toward the end of 1901, they experimented with miniature wings in a 6-foot wind tunnel, testing more than 200 types of wing surfaces set at different angles. They measured monoplane, biplane, and triplane models, and models in which one wing followed the other; they measured the lift produced by different aspect ratios (the ratio of span to chord) and found that the greater the span in proportion to the chord, the more easily the wing would be supported; they measured thick and thin surfaces. Among other things, these experiments proved the undesirability of the sharp edge at the front of a wing, then advocated by

others (although it has now been readopted for supersonic flight). They also learned that there was a loss in having one wing above another.

These experiments marked the turning point in attempts by man to fly. The Wrights now knew what no man had ever known before: how to compile tables of figures from which one might design an airplane that could lift itself and fly. Their 1902 glider, built from their own calculations, had a wing span of 32 feet, 10 feet more than one used in 1901, but the most noticeable change was the addition of a tail with fixed twin vertical vanes. In further experiments they discovered that the tail is a balancing device needed to supplement the presenting of the wings at different angles to the wind—the basic scheme of control used in all airplanes today. With the 1902 machine the Wrights made glides of more than 600 feet, and they could glide at a smaller angle of descent, closer to the horizontal, than the hawks that they observed. When they built their first power machine the next year, equipped with a motor of their own make, they felt sure it would fly.

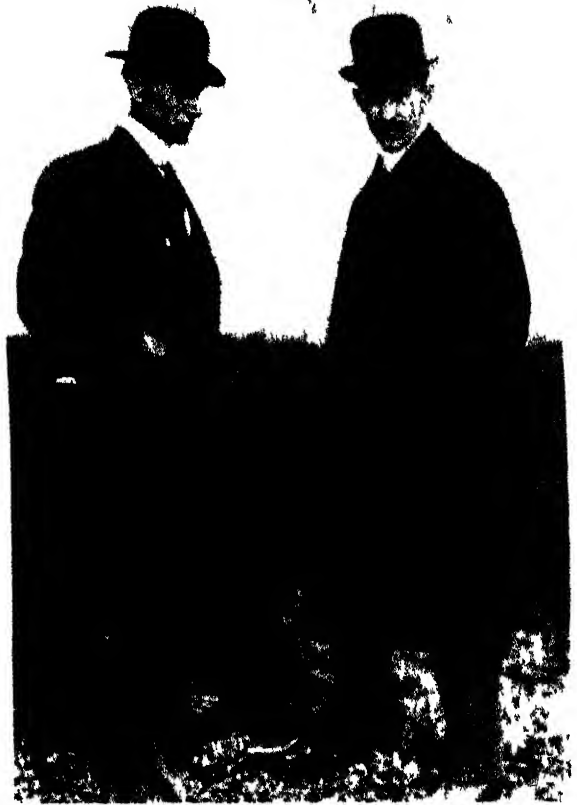
**Powered Flight.** On Dec. 17, 1903, at Kitty Hawk, Orville made the first flight of 120 feet; Wilbur, in the fourth and longest, made 852 feet in 59 seconds. During 1904 and 1905 they made further experiments at a field near Dayton, Wilbur achieving a flight of 24 miles in 1905. They closed a contract with the United States War Department for the first army plane in 1908, for which tests were completed in 1909. Meanwhile, in 1908, a Wright company was formed in France, where Wilbur gave demonstrations and trained pilots. In 1909 Orville flew in Germany, and Wilbur made sensational flights in New York City in connection with the Hudson-Fulton Celebration. By the end of 1909 an American Wright company had been organized. In 1948 the original plane flown at Kitty Hawk in 1903, which had been temporarily lent to the Science Museum at South Kensington, London, was returned to the United States for permanent exhibition in the National Museum at Washington, D.C.

FRED C. KELLY

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**WRIGHT, William Hammond**, American astronomer: b. San Francisco, Calif., Nov. 4, 1871; d. San Jose, May 16, 1959. He graduated from the University of California in 1893 and then pursued graduate work at the University of Chicago. In 1897 he was appointed assistant astronomer at Lick Observatory, University of California, and was in charge of the observatory's expedition to the Southern Hemisphere (1903–1906). He was made astronomer in 1908 and served as director of the observatory from 1935 to 1942. Wright won wide attention for his work on the gaseous nebular spectra and, pioneering in the use of infrared photography for astronomical purposes, secured the first clear pictures of Mars, on the basis of which he made tentative explanations of some of the planet's characteristics.

**WRIGHT-PATTERSON AIR FORCE BASE**, a United States Air Force base, 8 miles northeast of Day-



CULVER PICTURES

Wilbur (left) and Orville Wright, taking turns, made four powered flights at Kitty Hawk on Dec. 17, 1903.

ton, Ohio. The Air Force Logistics Command Headquarters, Air Force Museum, and 51 other tenant organizations share its 8,023 acres. It has twin airfields, now rare. The areas, formerly separate, include Wright Field (named for Orville and Wilbur Wright), and Patterson Field (named for Lt. Frank S. Patterson of Dayton, who was killed near the base on June 19, 1918, while testing a device for synchronizing machine gun fire with aircraft propellers). The base may be called the birthplace of Air Force research, development, and logistics. Aviation "firsts" originating here include the first solo instrument takeoff and landing and the first human ejection from a speeding aircraft.

RONALD GREEN

**WRIT**, rit, in Anglo-American law, a documentary order issued in the name of a court or of an executive officer, directing the person to whom it is addressed to do or refrain from doing a particular act described in the writ. The two principal categories are *prerogative writs* and *writs of right*.

Prerogative writs, frequently referred to as extraordinary remedies, are issued in the discretion of the court upon a showing that no other remedy adequate to the circumstances is available. Common examples of prerogative writs are mandamus, prohibition, quo warranto, habeas

corpus, and certiorari. The writ of mandamus is a command to a public official to perform a duty required by his office. The writ of prohibition forbids an inferior court or tribunal from continuing to conduct proceedings over which it has no rightful authority. The writ of quo warranto is an order to show by what authority an office or franchise is held. The writ of habeas corpus, in its most common form, is an order to bring before the court a person held in custody so that the legality of his restraint may be determined. The writ of certiorari issues from a superior court in order to review the record of evidence presented in the case before an inferior court. See also MANDAMUS; QUO WARRANTO; HABEAS CORPUS; CERTIORARI.

In contrast to these discretionary writs, which historically were a matter of the king's prerogative, writs of right were a category which the king was bound to issue under the terms of Magna Carta of 1215. The two main kinds of writs of right are *original* and *judicial*. Original writs were issued, without any order of court, from the King's Chancery. They are called original writs because they were the means of initiating every action at common law. The subsequent proceedings and the entire theory of the case were rigidly governed by the kind of original writ used, giving rise to the concept of the forms of action at common law. While the system of original writs has been abolished in England and was never widely used in the United States, the "form of action" concept still has some influence on Anglo-American law in spite of widespread procedural reforms which began in the 19th century. Judicial writs are issued by courts as a means either of initiating proceedings, of furthering proceedings in progress, or of executing the judgment of the court at the conclusion of the main proceedings. The most common judicial writ for initiating proceedings is the writ of summons, which demands the appearance of a specified person at a stated time before a court or officer and which generally specifies the complaint against him.

Much of the history of Anglo-American law can be told in terms of the supplanting of one form of writ by another (or by the fictionalized use of another) and the modification or abolition of many of the older writs in an effort to develop simpler and more effective legal processes. Hence nomenclature and usage vary widely among the many legal systems in the United States and the Commonwealth of Nations.

LAWRENCE WALLACE  
Formerly, Duke University

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**WRIT OF ASSISTANCE**, general search warrant issued to British customs officers by the superior courts of the American colonies. Writs were used to enforce the trade and navigation laws, and they authorized officials to search for smuggled goods without specifying either the location or the goods.

First issued in Massachusetts in 1751, writs

of assistance aroused no controversy until new ones were applied for ten years later. They were opposed as unlawful by Boston merchants, but instructions from England supported their legality in 1762. The Townshend Acts (1767) again authorized writs of assistance, and customs officers in all 13 colonies were directed to secure them from the superior courts. The writs were challenged in the courts in every colony, and many courts refused to issue them. Writs of assistance became an important colonial grievance.

**WRITERS' CRAMP** is a spastic condition of the writing muscles of the hand, first described by Sir Charles Bell in 1830. The ailment has also been known as *scriveners' palsy*. The disorder is associated with fatigue and prolonged use of these muscle groups. It has been classed as an occupational neurosis and compared to similar muscle palsies in other exacting occupations: for example, those of the calf muscles of professional dancers, the thumb muscles of tailors, and the thumb and forefinger muscles of telegraphers. There is no specific organic disease of the muscles, tendons, or nerves in the sufferer from writers' cramp; it is simply that he wants to write but cannot. Other unrelated motions of the hand can be performed with ease. Accurate diagnosis of the case is important, since sclerosing diseases of the brain, various types of neuritis and neuralgia, and at times inflammatory rheumatism can simulate this condition. A French school (François Thiebaut and others) in the *Revue Neurologique*, vol. 101, pp. 230-234 (Paris 1959), has described an electromyographic method of diagnosing writers' cramp.

Treatments of writers' cramp have been many and varied. The simplest device is rest, which may require up to six months. During this time, psychotherapy may be helpful. The electric typewriter, the teletype, and many other types of duplicating machines have made this condition of less clinical importance.

REAUMUR S. DONNALLY, M.D.

**WRITING**, rī'ting, the communication of ideas by means of conventional symbols that are traced, incised, drawn, or otherwise formed on the surface of some material such as stone, metal, bamboo papyrus, parchment, or paper. Although some animals communicate with one another by means of sound, only man communicates by means of writing; it is thus more peculiar to man than speech, which it supplements. Writing gives permanence to men's knowledge and enables them to communicate over great distances. Hence it is a necessary condition of civilization as we know it. The complex society of a higher civilization would be impossible without the art of writing.

#### ORIGINS

History does not throw much light on the origin of writing. We do not know who the inventor was; there probably were many. Nor do we know where or how far in the distant past the art first arose.

**Mythology.**—Because of the great value set upon the art of writing and the magical power it exercises over the unlearned, this precious possession of man was regarded as something beyond his unaided powers of creation. The ancient Egyptians ascribed the invention to Thoth, the god who invented nearly all the cultural elements, or to the goddess Isis. Babylonian mythology attributed it

Nebo (Nabu), Marduk's son, who was also the god of man's destiny. The ancient Chinese attributed it to the dragon-faced Ts'ang Chieh; the ancient Greeks, to Hermes or various other mythological characters, particularly Cadmus; the Romans, to their god Mercury. The Teutonic god Woden (Wotan, Wuotan) was credited with the invention of runes (q.v.), and the Celtic god Ogma (Ogmios) with the invention of ogam (q.v.). In pre-Columbian America, in Mexico, the Aztecs attributed writing to their god Quetzalcoatl. The ancient Indians and many other peoples also believed in the divine origin of their script. In the Bible there is no reference to the origin of writing, although there are passages dealing with the origin of other arts such as language, agriculture, music, and metallurgy; there is, however, a post-Biblical tradition which attributed the revelation of writing to Moses.

**Primitive Methods of Communication.**—From earliest times we can detect various parallel efforts to develop methods of human communication. Language led to the development of acoustic methods. The range of the human voice was extended by signaling with drums, horns or trumpets, flutes, and other instruments. Acoustic methods of communication, in turn, are allied with optical or visual methods such as gesture, mimicry, and signaling with light, fire, smoke, and other means.

There were also the carved message sticks of the primitive Australians, which carried intertribal messages; the notched sticks of ancient Scandinavia, which served similar purposes; and similar sticks used in ancient Russia, Italy, North America, and elsewhere, and still used in Africa, China, and Australia. Notched sticks, or tallies, were actually used by the exchequer of England down to 1832 as receipts for money paid into the treasury.

Property marks, pottery marks, tattooing, and similar distinguishing marks, even gravestones, belong to the same general category of visual communication. These were also memory-aid devices. The Australian churingas, sacred tablets covered with geometrical markings, were used as notations or memory aids for recounting the traditional myths of the origin of the tribe.

Of the knot devices—which were employed in ancient Tibet, Japan, Bengal, Persia, and Mexico, and are still used in East Africa, Polynesia, Peru and other places—the most celebrated is the quipu, or knotted cord, found in the ancient graves of Peru, which recorded administrative facts, registered the amount of taxes, and performed similar functions by the use of strings and knots of varied length, thickness, and color. The wampum belts of the North American Indians consisted of cords of colored shell beads, occasionally arranged in pictorial drawings; they served as legal instruments in ratifying treaties, confirming alliances, concluding contracts, and the like (white stood for peace, red for war or anger, black for death or misfortune, and yellow for gold or tribute). The calumet, or sacred decorated-reed tobacco pipe, was another Indian memory-aid device used for signifying war or peace.

**Sympathetic Magic.**—The various devices described in the preceding paragraphs may be regarded as prodromes of writing. It was a great step forward when, instead of using tangible objects as a means of communication, man began to "write"—that is, to scratch, draw, paint, or incise pictures of things. It may be assumed that at the beginning perishable writing materials were used

—such as leaves, bark, and wood. Needless to say, no such specimens have come down to us.

Of the prodromes of writing, the oldest extant are the devices connected with sympathetic magic. The world of primitive man was and is a world of magic. At some remote time in the Upper Paleolithic period, perhaps about 20,000 B.C., the cave dweller in southern France and northeastern Spain drew sketches of his prey—bears, buffaloes, deer, and other animals—on the wall of his cave and colored them with earths and vegetable dyes. He also drew sketches on the bones of the animals he killed and on rude stone implements. Some of these sketches are remarkable for their realism. (See PALEOLITHIC ART.) We may have here the beginning of art but hardly the beginning of writing. In the mind of the prehistoric man, the picture of the prey was in some way identified with the living animal; when the hunter pierced the image with his spear, in his mind the success of the coming hunt was assured. To this day Australian natives substitute sand drawings of the prey for the prehistoric ochre painting.

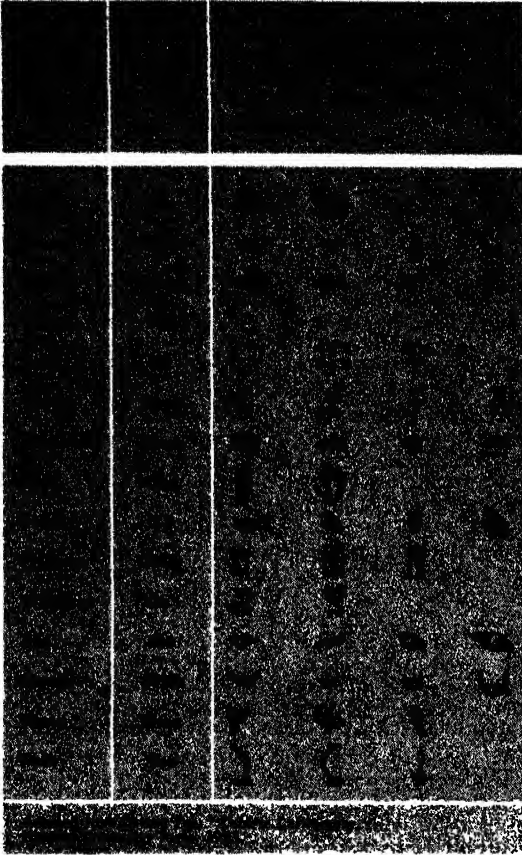
Probably to be included in the category of sympathetic magic are the various geometric signs or conventional figures of men painted or engraved on stones (termed petroglyphs) of megalithic tombs and similar monuments found in the Mediterranean and other regions, as well as on rocks found the world over dating from the Old Stone Age down to modern times. Expert opinion differs, however, as to whether the numerous river pebbles of the Azilian culture of the Middle Stone Age, containing dots and lines painted with peroxide of iron, also belong in this category.

#### CLASSIFICATION

Prehistoric man did not develop writing. However, as he became more civilized and social intercourse and trade increased, while magic and religion developed further, he doubtless felt the need of a more permanent and better organized form to replace his pictures, symbols, marks, and other means of communicating thought. We cannot know all the links in the chain of development of writing from its rude beginnings to the fully developed alphabetic script. Difficulties arise, too, when we try to fix in detail the stages of this development, to find exact terms for the various stages, to define them, and to ascribe individual scripts to them. We may attempt to distinguish two, three, or more groups of scripts, but we find that some of those that might be assigned, for instance, to Class 1 have features of Class 2 or 4, while others also assignable to Class 1 might be regarded as transitional from a memory-aid device to Class 3. In short, no scheme of classification is complete or wholly satisfactory.

The simplest method divides all scripts into two categories: ideographic and phonographic. Ideographic script is concerned with the representation of objects or ideas; phonographic, with the representation of sounds or spoken words. Another method distinguishes three historical stages: the figurative, the transitional or conventional, and the alphabetic. In the first stage, writing is supposed to be pictorial or immediately representative of objects. In the transitional period comes symbolical writing, in which abbreviated pictures are transformed into arbitrary symbols, first of things and in due time of sounds and words. Finally, when phonetic writing prevails, sounds are represented first in syllables and afterward in alphabetic symbols or letters.

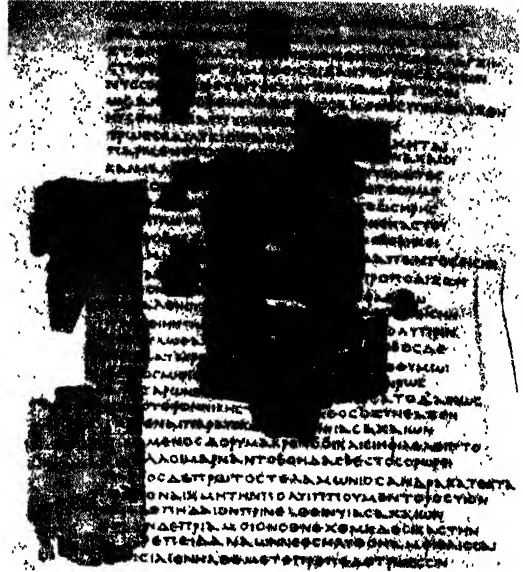




Left: Ideographic writing, as in cuneiform or Chinese, uses characters to represent objects or ideas. Such symbols become standardized over a period of years.

Below: The Greek alphabet is an excellent example of phonographic script, in which symbols represent the sounds of vowels and consonants. This fragment is a copy of a document from the 3d century, B.C.

New York Public Library



A more complicated and more complete method divides all writing into four stages of development, though it would be inaccurate and misleading to represent these stages as epochs in the progress of writing. Several of the scripts of Class 3 in this arrangement are considerably older than various known scripts of Class 2. Some scripts of Class 4 (the syllabic scripts) derive from scripts of Class 3, but others (the alphabetic scripts) are probably an independent invention. Indeed, the alphabetic system (Class 4b) belongs to a much earlier period than the great majority of scripts belonging to the other classes, except for the main scripts of Class 3. With this proviso, the stages of writing may be indicated schematically as follows:

**Class 1: Iconography.**—This consists of drawings of natural objects. The pictures represent the things shown: the sketch of an animal would represent the animal; a circle might represent the sun. The drawings are disconnected and fragmentary pictures, and give a static impression. The best known among these scripts are those of some North American Indian tribes.

**Class 2: Synthetic or Ideographic Writing.**—This consists of a series of pictures telling connected stories. Today, with action photographs, motion pictures, and comic strips, the introduction of action into pictures seems a small thing. As a matter of fact, it was a very important development when the "writer" began to "write" picture stories—that is, when he began to make pictures tell stories. From this arose the synthetic or ideographic type of writing, which can best be

studied in the scripts of primitive tribes in present-day Polynesia and Australia, in West Africa, among the Yukaghirs of northeastern Siberia, and particularly among the North American and Central American Indians.

**Class 3: Analytic or Transitional Systems.**—Neither of the two previous groups constitutes, or can be expected to constitute, a complete system of writing. Some scripts which can constitute a complete system and have been incorrectly termed ideographic may have been ideographic in origin, but even in the earliest inscriptions that have come to light they are partly ideographic (using pictographic symbols which suggest ideas or represent objects) and partly phonetic, the components being combined in various ways. The term "pictographic," also given to these scripts, is even less appropriate than ideographic. Another term used for them is "transitional," since they represent the transitional stage between pure ideographic writing and the pure phonetic system. A still better term is "analytic."

In the systems belonging to this category, a standardized picture, a pictogram that was as a rule easily reproduced and familiar to those using it, was selected by convention from the many that had been used for a particular thing and became the accepted symbol for this thing. At least originally, the name of the object, whether at rest or in some particular form of motion, was closely identified with the picture. Associated with pictograms were signs of a different type known as ideograms, which represented ideas, qualities, actions, and sometimes objects, none of which could be clearly

portrayed by a pictogram. The most famous scripts of the ancient world belong to this category, among them those of the Mesopotamian peoples, the Egyptians, and the Cretans (Minoans); the Indus Valley script; the Hittite hieroglyphics; and the Chinese, Mayan, and Aztec scripts. Of these, the Chinese system is the only one still in use. See ASSYRIOLOGY; CHINA—10. *Language*; CUNEIFORM WRITING; HIEROGLYPHICS, EGYPTIAN; HIEROGLYPHICS, HITTITE AND CRETAN; HIEROGLYPHICS, PRE-COLUMBIAN AMERICAN.

**Class 4: Phonetic Systems.**—In the iconographic and pure ideographic scripts, the symbols can be "read" in any language; there is no necessary connection between the symbols and the speech or sounds. Hence, we can examine and understand the pictorial and ideographic signs of any people who have ever existed without knowing what words they spoke. On the other hand, in phonetic systems, writing has become the graphic counterpart of speech. Each element of writing corresponds to a specific element of speech, a sound in the language, and the symbols cease to be self-evident pictures. The individual signs may be of any shape. Generally there is no connection between the external form of the symbol and the sound it represents, and the script must be explained through the language in which it is written. Phonetic systems may be subdivided into syllabic (Class 4a) and alphabetic (Class 4b):

**Class 4a: Syllabic Writing.**—In the systematic syllabaries, the individual signs represent syllables, the smallest elements of words that can be isolated and spoken. Thus, as the written symbols, or phonograms, of a syllabary are monosyllabic in value, a word of one syllable would be represented by one symbol, and a word of two or more syllables would be represented by two or more symbols or phonograms. The syllabic systems of writing developed more readily and appeared as new creations more often than the alphabetic.

In the case of a language that has many clusters of consonants, the syllabary becomes a cumbersome mode of writing, especially because it usually contains only open syllables (those made up of a consonant plus a vowel) or vowels when these constitute syllables. This is particularly noticeable in both the ancient Cypriote syllabary, in which the Greek word *ptolin* (city) was transliterated *u-to-li-ne*, and in the Minoan Linear B script deciphered in 1952. Needless to say, such a system would require a much greater number of symbols than alphabetic writing.

Of the syllabic scripts, the Japanese (of which there are two varieties, hiragana and katakana, both of which evolved from Chinese writing, in the 9th and 8th centuries A.D., respectively) are still in use. Some modern syllabaries have been devised by missionaries in West Africa, North America, China, and other countries. See also JAPAN—18. *Language*.

Two other scripts evolved from more complicated syllabaries and, without achieving true simplicity, almost reached the stage of alphabetic writing. One was the historically very important Old Persian script, the official script in cuneiform characters of the dynasty of the Achaemenids, under whose rule, from the middle of the 6th century B.C. until the victories of Alexander the Great, the ancient Persians attained the zenith of their power. The other was the Meroitic script, used in two varieties (monumental and cursive) from the 2d century B.C. to the 4th century A.D. in Meroë in ancient Nubia. While the Old Persian cuneiform

script was a mixture of alphabetic and syllabic signs, the Meroitic contained only two syllabic symbols, all the other signs being alphabetic.

**Class 4b: Alphabetic Writing.**—This may be fairly regarded as the finished product of the whole train of development. Alphabetic writing is the most highly developed and the most convenient system of writing, and it is readily adaptable to almost any language. An alphabet is a collection of a small number of symbols, generally between 20 and 40, known as letters, which are intended to represent the various phonetic elements of human speech, consisting of vowels and consonants.

Alphabetic writing is now almost universally employed by civilized peoples. No other system of writing has had so extensive, so intricate, and so interesting a history. It is now generally agreed that all existing alphabets, as well as those no longer used, derived from one original alphabet, the North Semitic, which probably originated about the 18th century B.C. in the region of Palestine and Syria. In its broad outlines, the story of the alphabet since the end of the 2d millennium B.C. is not very hard to trace, but many details of the development of some individual alphabets are still uncertain. For the history of the alphabet, see the article ALPHABET and separate articles on the individual letters.

#### STYLES AND DIFFUSION OF WRITING

**Epigraphy and Paleography.**—Although writing is not regarded as a separate branch of study, it forms the main basis of two important fields, epigraphy and paleography. Epigraphy deals with monumental or lapidary writing, in which the chief considerations are permanence and beauty, including evenness and proportion; speed of execution plays only a minor part. Even in alphabetic scripts the characters usually appear as separate units without ligatures. Whenever possible, they tend to be made up of independent strokes or scratches of the chisel, with as few curves as possible.

In the study of paleography, two styles of writing may be broadly distinguished: the ordinary cursive hand, informal or common, employed in everyday life; and the carefully written literary or book hand employed by trained scribes for copying literary works. In cursive or current writing, the chief considerations are speed and utility. Indeed, the current or running hand, as seen for instance in Egyptian hieratic and demotic writings or in Chinese or Latin cursive scripts, naturally assumes a less precise form. The shapes of the characters change quickly, sometimes within a generation; strokes become slurred; angles become more and more curved; superfluities are dropped; and ligatures are used. In the formal book hand there is greater emphasis on legibility, combined as a rule with uniformity; this results from the unhurried operation of a skilled craftsman employing characters that are stabilized in form.

The two classes, the current or informal hand and the formal or book hand, were not always kept distinct. Books were copied in the current hand by a scholar for his own private study, or else by a scrivener or copyist, and quite often the original was written in the current hand by the author himself. On the other hand, documents that would normally be written in the current hand might, for some special reason, have been written in a book hand or formal script, and this

hand was sometimes employed for more important official letters or even for private correspondence. These are, however, exceptional cases. Generally speaking, there always existed a degree of competitiveness between the book hand or formal script and the natural, informal current hand. Both styles, and the monumental style also, were based on the same script and were used concurrently, but the different purposes of the proposed documents—for example, for a presentation or some other special occasion when something ornate might be required—set different stylistic ideals before the scribe. The different materials used, and particularly the tools employed, also favored different styles of writing.

See also ARAB CIVILIZATION—2. *Language*; ILLUMINATED MANUSCRIPTS; PALEOGRAPHY.

**Idea Diffusion or Stimulus Diffusion.**—The theory of idea diffusion or stimulus diffusion provides the best explanation of the origin of some important scripts in the ancient world, such as Egyptian hieroglyphics and the Chinese script. According to this theory, after writing had developed in Mesopotamia, the generic idea, when it reached Egypt and China, induced some important personality in each of these countries to invent a script for Egyptian and Chinese speech. This theory may also explain the origin of the Teutonic runes and the Celtic oghams, and perhaps several other scripts.

**Alphabets and Religion.**—While it is true to say, in certain instances, "The alphabet follows trade," and, in others, "The alphabet follows the flag," the diffusion of the alphabet throughout the world for about 2,000 years may be summed up in the aphorism "The alphabet follows religion." Interestingly enough, while few examples of the Latin alphabet survive from the first five or six centuries of its existence, from the 1st century B.C. onward Latin inscriptions become too numerous and too widespread geographically to be counted. The Latin language and script were carried by Roman legionaries and imperial officers to all parts of the vast Roman Empire, particularly to the regions which were not Hellenized. In later centuries, however, churchmen and missionaries carried Latin language and script still farther afield. Catholic Rome was then the light of the Western World, the center from which religion and learning were disseminated to all parts of western, central, and northern Europe. The ascendancy of Latin led to the adoption of the Latin alphabet by a large majority of nations, and it was adapted to tongues of the most diverse linguistic groups.

Two alphabets, the Cyrillic and the Glagolitic, were employed for writing the early Slavonic language. Of the two, the Cyrillic (based on the Greek uncial alphabet of the 9th century A.D.) developed in the course of time into the national scripts of those Slavonic peoples who accepted their religion from Byzantium, namely the Russians, White Russians, Ukrainians, Bulgarians, and Serbs. Through the Russian script, the Cyrillic alphabet has also been adopted for several Finno-Ugrian, Turki, and Iranian languages. On the other hand, Roman Christianity brought the use of the Latin alphabet to the Poles, Czechs, Slovaks, Lusitians, Wends, Slovenes, and Croats. The most interesting case is that of Serbo-Croatian, which is a single speech although it is written differently by the Orthodox Serbs and the Roman Catholic Croats. Thus the line of demarcation between the Eastern and the Western

churches runs right through the Slavonic <sup>ies.</sup> With one small exception (the Roman Catholic Slavs of the western Balkan Peninsula still employ the Glagolitic script for liturgical purposes), wherever the church is Roman the Latin alphabet is used; where it is Orthodox, the Cyrillic alphabet is used. See also ALPHABET—8. *Slavonic Alphabets*; CYRILLIC ALPHABET.

In the history of the alphabet, the Aramaic branch occupies in the East a place comparable with that of the Latin alphabet in the West. From the 7th century B.C. onward, and particularly in the second half of the 1st millennium B.C., the Aramaic language and script became by far the most important and widespread in the whole of western Asia. In the late 3d century B.C. and during the succeeding centuries, numerous Aramaic offshoots became distinct entities. The hundreds of direct and indirect descendants of the Aramaic alphabet can be divided into two main groups, those used for the Semitic and those for the non-Semitic languages. Many of these scripts exemplify the aphorism that "the alphabet follows religion." This is particularly the case with the Hebrew and Arabic scripts, but it is also largely true of the Syriac-Nestorian, Mandaean, Manichaean, Pahlavi, Armenian and Georgian, and the Buddhist scripts of the Indochinese Peninsula.

The Syriac-Nestorian script was used by the extremely active Nestorian missionaries, who carried their religion, their Syriac language, and their script into the Kurdistan highlands, southern India, and Turkestan, and to other Turki as well as Mongol tribes of Central Asia; they even penetrated into China. The script of the Manichaeans also spread with their religion, which, from the middle of the 3d century A.D. to about 1200, was one of the most widely disseminated in the world. Similarly, the Pahlavi scripts of the sacred pre-Islamic literature of the Iranians were disseminated with Zoroastrianism and are still used for liturgical purposes, particularly by the Parsis of India. The Buddhist monks likewise made their scripts the vehicle of their culture; a unique empire was built up, based not on political and military unity, but on the common cultural and spiritual life of peoples who were more or less independent politically. Buddhism, indeed, played a role in Southeast Asia similar to that of Roman Christianity in Europe in the Middle Ages.

The Arabic alphabet is, after the Latin script, the one now most generally used in Asia and Africa. As the language and script of the Koran, the holy book of Islam, Arabic spread with the expansion of this religion as far as western and central Africa, southern Europe, southern Russia, India, and Indonesia. The script has been adopted for, and adapted to, a great number of Asian and African tongues and in times past, in Europe, to such languages as Spanish and Bosnian Slavonic. See also COMMUNICATION; CRYPTOLOGY; SHORTHAND.

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**WROCLAW**, vró'tsláf, is a large industrial city in Poland. Called *Breslau* in German, it was the historic capital of Silesia. It is now the capital of Wrocław province. Wrocław lies on the Odra (Oder) River, 190 miles (310 km) southwest of Warsaw and about 280 miles (460 km) from the Baltic Sea. The city grew during the early Middle Ages on a small defensible island in the river, and became the seat of the bishop and the site of the cathedral in the 13th century. In that century, however, a commercial city developed under German influence on the south bank of the river. It was laid out on a pattern of rectangular blocks, with a large central marketplace where the remarkable Gothic town hall was built in the 14th–15th centuries. The new town absorbed the island town in the 14th century.

The growth of Wrocław was assisted by its excellent communications and by the rich farmland that surrounds it. The city passed to Bohemia in 1335, then to Austria in 1526, and subsequently to Prussia in 1742. In the 19th century it developed into an important industrial city, with mechanical engineering and textile industries predominating. In World War II the city was defended by the Germans against the Russians for a short time and suffered severe damage. The historic monuments, however, were preserved. In 1945, Wrocław was returned to Poland. Population: (1964 est.) 469,400.

NORMAN J. G. POUNDS, *Indiana University*

**WRONG**, rông, **George Mackinnon**, Canadian historian: b. Grovesend, Ontario, Canada, June 25, 1860; d. Toronto, June 29, 1948. He graduated from the University of Toronto in 1883, was ordained in the Anglican ministry, and began to teach church history and other courses at Wycliffe College in Toronto. Nine years later he joined the faculty of the University of Toronto, where he was professor of history from 1894 to 1927. Wrong was an impressive and popular teacher, but even more important was his influence in raising the standards of historical scholarship in Canada. In 1897 he founded, and for 30 years edited, the *Review of Historical Publications Relating to Canada* (incorporated in the *Canadian Historical Review* in 1920); and from 1905 to 1922 he was editorial secretary of the Champlain Society, publishing rare materials on Canadian history. He was also coeditor of the *Chronicles of Canada* series (32 vols., 1914–16) and contributed *The Conquest of New France* (1918) and *Washington and His Comrades in Arms* (1921) to the *Chronicles of America* series. Among his other books are *The Rise and Fall of New France* (2 vols., 1928), *Canada and the American Revolution* (1935), and *The Canadians, the Story of a People* (1938).

**WRÓŃSKI**, vrôn'ya-skē, **Józef Maria** (real surname **HOENE**; known as **HOENE-WRÓŃSKI**), Polish mathematician and philosopher: b. near Poznań, Poland, Aug. 24, 1778; d. Neuilly-sur-Seine, France, Aug. 9, 1853. After serving in the Polish and Russian armies, he studied philosophy and mathematics in Germany and settled in Paris about 1800. At first a disciple of Immanuel Kant, whose metaphysics he sought to reconcile with the calculus of Gottfried Wilhelm von Leibniz, he gradually developed a social philosophy, known as messianism, to resolve the conflicting views of liberal and conservative factions, and he held that absolute truth might be established by

means of mathematical formulas. He applied his system to mathematical analysis, the theory of numbers, and the theory of probabilities. He is best remembered for his "Wronskian determinants" (see **DETERMINANTS**), but he contributed to the knowledge of celestial mechanics and several branches of physics. The extravagances and mysticism of his messianism kept him from having much influence in his own time, but reappraisal of his mathematical contributions has added substantially to his reputation.

**WROXETER**, rók'sə-tər, village, England, in Shropshire, six miles southeast of Shrewsbury. Here are the remains of the Roman Viroconium (Uriconium, Virconium), originally (48 A.D.) a base camp guarding the point where Watling Street crossed the Severn River. About 75 A.D. a civilian town was founded, occupied by the Cornovii. It was partially rebuilt about 120 A.D., and by the mid-2d century was the fourth largest in the country. By the 5th century, however, it had been abandoned with the founding of the town of Shrewsbury by the Anglo-Saxons; the ruins became quarries of building stones. The principal visible remains are parts of the 2d century baths and the forum. A small museum contains objects found on the site. Pop. (1963) 993.

**WRYBILL**, rī'bīl, a plover (*Anarhynchus frontalis*) of New Zealand noted for its strange bill, which is bent sideways to the right along its distal half. The bird measures eight inches in length and is gray above and white below with a black band across the breast. Except for the bill, it resembles many ring-necked plovers. The deviation remains unexplained, although some ornithologists believed at one time that it was an adaptation for searching under rounded stones.



M. F. Saper from National Audubon Society

The wrybill of New Zealand is distinguished by a strange beak, always bent to the right.

Modern studies have failed to substantiate this or to reveal any abnormality in behavior, but the wrybill is also unusual in that it normally lays only two eggs, whereas most plovers usually lay four.

**WRYNECK**, rī'nēk, one of two species forming the subfamily Jyninae of the woodpeckers. Wrynecks are considered to be primitive mem-

bers of the woodpecker family because they lack many of its specialized characters, such as the stiffened tail, and do not bore for food or dig their own nest holes. They differ also in the texture of their plumage, which is much softer than that of the woodpeckers and differently colored, being grayish or reddish brown and very delicately mottled. In fact, they resemble superficially a small nightjar or a songbird much more than they do a woodpecker. The name wryneck refers to their ability to twist and contort the neck at extraordinary angles. The better known wryneck (*Jynx torquilla*) measures six inches in length and is found virtually throughout the forests of Eurasia except in the tropics; it also inhabits northwestern Africa. In the rest of Africa it is replaced by the slightly larger and more colorful *J. ruficollis*. See also WOODPECKER.

CHARLES VAURIE.

**WU-CH'ANG.** See WUCHANG.

**WU-HSI.** See WUSIH.

**WU PEI-FU**, wō'pā'fō', Chinese general: b. Penglai, Shantung, China, 1878; d. Peking, Dec. 4, 1939. Although interested all his life in philosophy and poetry, he trained for an army career, graduating from the military academy at Tientsin in 1898. Under the Ch'ing dynasty he distinguished himself in several minor campaigns. After the republic was established in 1912, he became one of the most important war lords of northern China, the champion of the peace-loving middle classes and ruler of five major Chinese provinces. In addition to the monarchists, his chief opponents were Sun Yat-sen in the south, who was too weak to attack, and Chang Tso-lin in Manchuria. Wu Pei-fu defeated Chang in 1922 but was defeated by him in 1924 when his own ally Fêng Yü-hsiang defected to Chang. He suffered a final defeat when he attempted to oppose Chiang Kai-shek and the Kuomintang Army in their advance northward in 1926-1927. He then retired to a Buddhist monastery, refusing in 1937-1939 to aid the Japanese in their conquest of China or to become head of the puppet government they set up.

**WU TAO-TZŪ**, wō'dou'dzū', Chinese painter: b. about 700; d. about 770. There seems to be no reason to doubt that he was the greatest painter of the T'ang dynasty, but because he was above all else a Buddhist painter, most of his work perished, along with other similarly inspired art of the T'ang, during the anti-Buddhist persecutions of the 9th century. Literally nothing remains of Wu Tao-tzū's work; neither the questionable copies (Jungkung collection, Chicago; Abe collection, Ōsaka, Japan) nor the stone rubbings supposedly derived from his monochrome drawings can be true measures of his gifts. In 1952 Shujiro Shimada, a Japanese critic, finally demolished the claim that Wu was the painter of *Autumn Landscape*, in the Kōtō-in temple in Kyoto, Japan, assigning the work to Li T'ang, an artist of the Sung dynasty.

Wu may have used a curiously violent style, with draperies swelling out as if caught by a heavy wind. But this tradition contradicts what is generally known about Buddhist painting, and it has been argued convincingly that refer-

ences to Wu's so-called violent style meant merely that he used a free brush stroke and aspired to plasticity. It is conceivable that the wall paintings in the Hōryūji temple in Nara, Japan, may have had some relation to the art of Wu Tao-tzū; but these were damaged by fire just after World War II. Finally, some parts of the complex series of the cave temples of Tun-hwang, in the Chinese province of Kansu, may reflect the style of this lost master, all 300 of whose temple frescoes, apart from other works, have totally disappeared.

See also CHINA-14. *Art (Painting)*: Painting of the T'ang Dynasty; *PAINTING—Eastern Art (Chinese Painting)*: T'ang Artists.

WALLACE BROCKWAY.

**WU T'ING-FANG**, wō't'ing'fāng', Chinese statesman and diplomat: b. Kwangtung Province, China, 1842; d. Canton, June 23, 1922. Following his early education at St. Paul's College in Hong Kong, he studied law at Lincoln's Inn, London (1874-1877). He then returned to the East and practiced law in Hong Kong. In 1882 he was appointed to the official staff of Li Hung-chang, then governor general of Chihli (Hopti) and grand chancellor of China, and in 1895 was one of the peace commissioners who negotiated the Treaty of Shimonoseki following the Chinese-Japanese War. He later occupied high government offices at Peking and, as minister of the board of punishment (1905-1906), reorganized the penal code. Wu T'ing-fang was minister to the United States in 1896-1902, 1908-1909, and 1912. He supported the revolution in 1911 and between 1916 and 1921 occupied various posts in the Canton government. His volume of impressions of the United States, *America Through the Spectacles of an Oriental Diplomat* (1914), received wide attention.

**WUCHANG** or **WU-CH'ANG**, wō'ch'āng', city, China, administrative and cultural center of the Wuhan urban complex (Wuchang, Hankow, and Hanyang) in east-central Hupei Province (see WUHAN). A port on the right bank of the Yangtze River at the mouth of the Han, Wuchang has tanning, paper manufacturing, and cotton- and silk-weaving industries, and is the seat of Wuhan University and of several colleges and institutes in the fields of agriculture, engineering, fine arts, law, water conservancy, and medicine, and a government mint. Commercial suburbs and the Hankow-Canton rail terminus extend along the Yangtze River north of the old walled city.

The oldest of the Wuhan cities, Wuchang dates from the 3d century A.D. It was a provincial capital under the Yüan (Mongol) dynasty in the 13th century and became the capital of Hupei Province in the 1660's. One of the first incidents of the Chinese Revolution of 1911 occurred here, and in 1927 the city was occupied by Nationalist forces. It became an independent municipality in 1935. From 1938 to 1945 it was controlled by the Japanese and was taken by the Communists in 1949. Pop. (1953) 400,000.

NORTON S. GINSBURG.

**WUCHI MOUNTAINS** or **WUCHIH SHAN**, wō'jē', mountain system, China, occupying a major part of the Li-Miao Autonomous Chou in south-central Hainan Island, Kwangtung Province. They are inhabited chiefly by Li and Miao



borigines and are covered by virgin forest. At their highest elevation, the mountains rise to 11,118 feet. They are made up of five distinct ranges which extend, fingerlike, toward the south. The name means "five fingers" in Chinese.

BARUCH BOXER.

**WUCHOW** or **WU-CHOU**, wōo'jō', municipality, China, near the eastern border of the Kwangsi Chuang Autonomous Chou, about 120 miles west of Canton. Situated at the head of steamer navigation on the Si Kiang (West River) where it receives the Kwei, Wuchow is a port and trade center in the heart of an area producing bamboo, millet, rice, and wheat. It has a substantial chemical industry (producing sulphuric acid especially) and is a cotton-weaving and silk-processing center. It was opened to foreign trade in 1897, served as a United States airbase during World War II, and was briefly occupied (1944-1945) by the Japanese. Gold deposits are found nearby. From 1913 to 1946 it was known as Tsangwu. Pop. (1953) 110,800.

NORTON S. GINSBURG.

**WUHAN**, wōo'hān', municipality, China, capital of Hupei Province, on the Yangtze River at the mouth of the Han. Made up of the three important cities of Wuchang (east of the Yangtze), Hankow (north of the Han and west of the Yangtze), and Hanyang (south of the Han), Wuhan is the largest municipality in central China and serves as the focal point of economic and political activity in the rich Yangtze Valley region. It is a major transportation hub and industrial and administrative center, situated where the Peking-Canton Railway crosses the Yangtze, and is the site of two famous railway bridges, the Yangtze River bridge which connects Wuchang with Hanyang, and the Han River bridge connecting Hankow and Hanyang. Wuhan is the site of one of the earliest modern steel mills in China and is being developed as a new center of metallurgical and related industries. It is already the major textile producer in central China and has a wide variety of light manufacturing industries, two railway plants, and one of China's most important arsenals.

Historically, the Wuhan area has been famous as the seedbed of revolutionary movements. In 1911 the revolutionary activity that gave birth to the Chinese Republic erupted among the steelworkers at the Hanyang steelworks, and during the 1920's Hankow was a center of political conflict between the Communists and the Nationalists during the short-lived coalition that was terminated in 1927-1928. More recently, the Wuhan agglomeration was the site of a major reconstruction program to provide public recreational facilities, including parks and "cultural palaces." Of the three cities making up the municipality, Hankow is noted chiefly as a manufacturing and trade center, Wuchang as an educational and administrative center, and Hanyang as a center of heavy industry. Pop. (1958) 2,226,000.

BARUCH BOXER,

Assistant Professor of Geography, Indiana University.

**WUHSIEN.** See SOOCHOW.

**WUHU**, wōo'hōo', municipality, China, in southern Anhwei Province. The major industrial and

commercial center of the province, Wuhu is an important Yangtze River port and rail hub, 60 miles southwest of Nanking. Major industries include silk and cotton weaving, egg processing, flour milling, and tanning; rice, cotton, and tea are traded. Wuhu was opened to foreign trade in 1877, and a foreign settlement was established here in 1905. The city was occupied by the Japanese from 1938 to 1945. Pop. (1953) 242,100.

NORTON S. GINSBURG.

**WULFENITE**, wōolf'fē-nīt, a minor ore of molybdenum, native lead molybdate,  $PbMoO_4$ . The best specimens are among the most beautiful minerals known. Wulfenite crystallizes in hemimorphic tetragonal crystals, usually in square tabular plates, sometimes very thin and transparent, but occasionally in elongated pyramidal forms and nearly opaque. The mineral also occurs in crystalline masses. It is very brittle, has a hardness of about 3, and is very heavy, its specific gravity ranging from 6.7 to 7.0. Its luster is resinous to adamantine, and colors are various shades of yellow, orange, red, grayish, or greenish. It is associated with other lead ores at many localities, as in Austria and New South Wales, but the United States localities are far more important. Magnificent specimens occur in the Red Cloud and Mammoth mines of Arizona, in New Mexico, Nevada, and Utah. It was named in honor of the Austrian mineralogist Franz Xaver von Wulfen (1728-1805).

**WULFSTAN**, wōolf'stān, the name of several Anglo-Saxon clerics:

**WULFSTAN OF WINCHESTER:** fl. 1000. A monk of St. Swithun's, Winchester, he is remembered for his metrical lives of St. Swithun and St. Ethelwold.

**WULFSTAN:** d. York, England, May 28, 1023. He was archbishop of York from 1003 and bishop of Worcester (1003-1016). He is known for the many homilies attributed to him. The most famous of these is *Lupi sermo ad Anglos*, describing the desperate state of affairs after the Danish raids; it was first printed in 1703-1705 in a translation by George Hickes.

**WULFSTAN or WOLSTAN, SAINT:** b. Long Itchington, Warwickshire, England, c. 1012; d. Worcester, Jan. 18, 1095. Educated at Evesham and Peterborough, he was ordained a priest about 1038 and became a monk in the monastery of Worcester. In 1062, in spite of his objections, he was consecrated bishop of Worcester. He was one of those who submitted to William the Conqueror at Berkhamstead in 1066 and was allowed to retain his see. In 1084-1089 he built a cathedral at Worcester, the crypt of which survives in the present edifice. While not distinguished for extraordinary learning or intellectual attainments, Wulfstan was a man of saintly character and great diligence in his ecclesiastical duties, and is credited with having put a stop to the practice of the merchants of Bristol of selling their fellow citizens into slavery in Ireland. He assisted in the Domesday survey and led the defense of Worcester against the rebellious nobles in 1088. He was the last English bishop to be appointed by a Saxon king and thus formed a link between the old church and the church of Lanfranc and Anselm. He was buried in Worcester Cathedral and canonized in 1203, his day being January 19.

**WUNDT**, vōōnt, Wilhelm, German and founder of scientific psychology: b. Neckarau, near Mannheim, Germany, Aug. 16, 1832; d. near Leipzig, Aug. 31, 1920. Even in boyhood he studied assiduously and never engaged in play. He earned the degrees of Ph.D. and M.D. at Heidelberg, where for 17 years he was a lecturer in physiology. In 1874 he was appointed professor of philosophy at Leipzig, the university with which his name is most closely associated. There in 1879 he opened the first laboratory of experimental psychology in the world, attracting graduate students from many countries. Among them there were many Americans, who returned from their study with Wundt determined to found similar laboratories, advance the new psychology, and achieve complete independence from philosophy.

The sheer volume of Wundt's publications is amazing. He wrote articles and books on physiology, psychology, and philosophy for nearly seven decades. His first paper, a report on the sodium chloride content of urine, was published in 1853. In 1920 he brought out the 10th and final volume of *Völkerpsychologie* (Folk Psychology). It is estimated that he produced erudite papers and books at the rate of 2.2 printed pages a day. He also encouraged his students to publish research articles, and in 1881 he established the *Philosophische Studien* as a journal for the publication of reports on work done by him and his disciples in the laboratory for experimental psychology and the libraries at Leipzig.

A man of encyclopedic factual knowledge, Wundt sought to identify the elements of consciousness and to state the principles by which these elements are combined. In his studies of the higher mental processes he sought for scientific knowledge through observations of social behavior, particularly of the customs and the language systems prevalent in various ethnic groups. His treatises on philosophy are chiefly an extension of the views he developed in scientific psychology.

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**WUOTAN.** See ODIN.

**WUPATKI NATIONAL MONUMENT**, wōō-pāt'kē, a national monument in Arizona, 28 miles north-east of Flagstaff. It was established on Dec. 9, 1924, and embraces about 56 square miles. The monument preserves some 800 archaeological sites which demonstrate remarkably the effect of natural forces on man. Wupatki (Hopi for "tall house") is the principal site in the monument.

Prior to 1064 A.D. Indians in the area lived in single-room pit houses, widely scattered to take advantage of the few places where there was farmland suitable for growing corn, beans, and squash. In 1065 Sunset Crater erupted, driving the inhabitants away and depositing a layer of volcanic ash over an area of 800 square miles. Enterprising individuals soon discovered that this ash acted as a mulch, inhibiting the evaporation of subsurface moisture; thus the volcanic sand made farming possible in an area which today receives an average of only seven inches of rain a year.

New types of housing, especially masonry

pueblos, and pottery indicate that people migrated into the region from all directions, creating an unusual blend of cultural elements. The Citadel, a ruin showing northern affiliation, stands only 50 yards from Nalakihi ("lone house"), whose people apparently came into the area from the south and west. At the height of their prosperity, these people traded for shell from the Gulf of California and the Pacific coast, for copper bells and parrots from Mexico, and for decorated pottery from the Four Corners region. Drought and the removal of volcanic ash by wind erosion drove the inhabitants away by 1300 A.D.

**WUPPER RIVER**, vōōp'ər, river, Germany, in the State of North Rhine-Westphalia. It is formed at Wipperfürth by various headstreams and flows some 65 miles first northwest and then southwest to empty into the Rhine at Leverkusen between Cologne and Düsseldorf. Although the Wupper follows a tortuous course and does not lend itself to navigation, it provides considerable power for manufacturing purposes, and its valley is densely populated; in it lie the important industrial cities of Wuppertal, Remscheid, and Solingen.

**WUPPERTAL**, vōōp'ər-täl, city, Germany, in the State of North Rhine-Westphalia, about 15 miles east of Düsseldorf. It extends for 8 miles along the steep slopes on both sides of the Wupper River, the course of which is followed by the Schwebbahn, a suspended monorail transportation system built in 1901 (see MONORAIL). Wuppertal is an industrial city, its chief products being textiles, including silk, velvet, linen, artificial fibers, carpets, upholstery materials, ribbons, and the like. Iron and steel milling and the manufacture of ball and roller bearings are also important. Other industries include food processing and the manufacture of pharmaceuticals, dyes, firearms, organs and pianos, paper, and leather. Wuppertal is home to a noted clock museum and several colleges for specialized study.

The region about Wuppertal was settled in the 11th and 12th centuries, and numerous communities developed there later. In 1929 the municipalities of Barmen, Elberfeld, Ronsdorf, Beyenburg, Cronenberg, and Vohwinkel were incorporated under the name of Barmen-Elberfeld, and in 1930 the name was changed to Wuppertal.

The famous Elberfeld system of poor relief, later adopted by many other German cities, was instituted here in 1853; under this system, qualified citizens were obliged to serve as almoners to see that the needs of the destitute were taken care of and that every effort was made to channel their abilities into useful activities. Owing to its industrialization, the city was heavily bombed during World War II but has since regained its prosperity. After the war it was included in the Federal Republic of Germany (West Germany). Pop. (1980) 393,381.

**WURMSER**, vōōrm'zər, COUNT **Dagobert Siegmund von**, Austrian general: b. Strasbourg, France, May 7, 1724; d. Vienna, Austria, Aug. 21, 1797. He served first in the French Army, but left it in 1747 for the Austrian service. In the Seven Years' War he commanded a hussar regiment and attained the rank of major general.

While in command of a special corps in the War of the Bavarian Succession, he distinguished himself at Habelschwerdt (1779). He was again in charge of a corps in the wars of the French Revolution. Defeated at Wissembourg in 1793, he was victorious at Mannheim in 1795. In the following year he was placed in command of the Austrian army opposing Napoleon Bonaparte in Italy. With 45,000 men he compelled the French to raise the siege of Mantua, but defeats at Castiglione, Rovereto, and Bassano made the Austrian situation precarious. Finally Wurmser forced his way into Mantua, whose blockade was resumed. Although another Austrian army was sent to Italy, defeat at Arcole prevented it from relieving him, and on Feb. 2, 1797, Wurmser was obliged to surrender Mantua to Bonaparte.

**WÜRTTEMBERG**, vür'tam-bērKH, former state, Germany, bounded on the northeast and east by Bavaria; on the south by Bavaria, the Lake of Constance (separating it from Switzerland), and the former Prussian Province of Hohenzollern; and on the southwest, west, and northwest by the former State of Baden. It had an area of 7,532 square miles and a population (1939) of 2,907,166. Stuttgart was the capital.

The terrain of the area, which is hilly throughout, includes the Swabian Jura and parts of the Black Forest in the south and west. The Neckar River, canalized from Stuttgart down, connects the center and north with the Rhine Valley. The upper Danube, flowing through the south, is not navigable. The area is not endowed with resources favoring industrial development; nevertheless, while agriculture and forestry have remained important in its economy, its manufactures are prosperous and varied. Among the most important of these are wood, paper, textiles, and metal goods. Leading cities, besides Stuttgart, are Heilbronn, Ulm, Esslingen, Reutlingen, and Göppingen.

**History.**—The first counts of Württemberg appeared in the 12th century as minor lords of the Duchy of Swabia, then in the hands of the imperial Hohenstaufen dynasty. The fall of this dynasty and the disintegration of Swabia gave the counts the opportunity to acquire substantial possessions in central Swabia in the 14th century. Emperor Maximilian I made Count Eberhard V duke of Württemberg as Eberhard I in 1495. In 1534 the Lutheran Reformation was introduced in the duchy. Duke Christoph (r. 1550–1568) systematically perfected Protestant institutions, creating a much-admired educational system headed by the University of Tübingen, which had been founded in 1477. The duchy suffered terribly in the Thirty Years' War (1618–1648).

The dissolution of the Holy Roman Empire and the reorganization of Germany by Napoleon in 1803–1810 doubled the area of Württemberg, which received the Swabian possessions of Austria, a number of free imperial cities, and many ecclesiastical and secular dominions. Duke Frederick II became elector in 1803 and king as Frederick I in 1806. Through its expansion in the north, Württemberg gained some Franconian territories. Moreover, it lost its exclusively Protestant character by absorbing many Roman Catholics, who have since formed about one third of its population. Nevertheless, it remained essentially a Swabian state, and its cultural unity helped to form a strong state patriotism.

German liberalism developed its greatest strength in southwestern Germany. The grant of

a constitution in Württemberg by King William I (r. 1816–1864) in 1819 did not stifle the liberal and democratic movement, which demanded additional internal reforms and the unification of Germany, and the people of Württemberg played a prominent part in the abortive German revolution of 1848–1849. With the other south German states, Württemberg fought on the side of Austria against Prussia in the Seven Weeks' War of 1866. In November 1870, however, under King Charles I (r. 1864–1891), it agreed to enter the new German Empire, which came into being in January 1871. Within the empire, Württemberg developed its own liberal institutions. In 1906, under King William II (r. 1891–1918), universal, direct, secret, male suffrage was introduced for the second chamber.

In 1919 Württemberg became a republic within the Weimar Republic. The National Socialist regime which came into power in 1933 in effect abolished all the German states, and Württemberg was ruled by a governor appointed by Adolf Hitler. In 1945 northern Württemberg and northern Baden were included in the United States occupation zone as the new state of Württemberg-Baden. Southern Württemberg, Hohenzollern, and southern Baden, forming the states of Württemberg-Hohenzollern and Baden respectively, came under French control. These three rather artificial states became constituent members of the Federal Republic of Germany when it was formed in 1949; but after the removal of occupation controls, a plebiscite was held in the states in December 1951 on a proposal to form a single southwestern state. The merger was approved, and the new State of Baden-Württemberg, with its capital at Stuttgart, was formed in 1952.

HAYO HOLBORN,  
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**WURTZ**, vürts, Charles Adolphe, French chemist: b. Strasbourg, France, Nov. 26, 1817; d. Paris, May 12, 1884. He received a medical degree from the University of Strasbourg in 1843, went to Paris the following year, and in 1845 became assistant to Jean Baptiste Dumas in the Faculty of Medicine at the Sorbonne. He served as professor of chemistry and toxicology there from 1852 to 1875 and also as dean of the Faculty of Medicine (1866–1875). In 1875 he was appointed to the chair of organic chemistry in the Faculty of Sciences and in 1881 was elected a senator. His notable contributions to the advancement of organic chemistry include the discovery of methyl and ethyl amines (1849), glycol (1856), and aldol (1872). The Wurtz column and the Wurtz-Fittig reaction for synthesizing organic halogen compounds are named for him, as is the mineral wurtzite. In addition to the famous *Dictionnaire de chimie pure et appliquée* (3 vols., 1868–78; supplement, 1880), his writings include *Traité élémentaire de chimie médicale* (2 vols., 1864–65), *La théorie atomique* (1878), and *Traité de chimie biologique* (1885).

**WURTZITE**, würt'sīt, a brownish black mineral of composition ZnS (zinc sulfide) that crystallizes in the hexagonal system. Zinc sulfide exists in nature as both sphalerite,  $\alpha$ -ZnS, also called blende (q.v.) or zinc blende, and wurtzite,  $\beta$ -ZnS, the latter mineral being the rarer of the two. Significant deposits of wurtzite are found in Missouri and Montana in the United States; Cornwall, England; Bohemia, Czechoslovakia; and France. The

## WÜRZBURG

mineral has specific gravity 4.0, hardness 3.5, and good prismatic cleavage. The wurtzite lattice is one of the reference structures for ionic crystals, and as such it has been intensively studied by crystallographers. Wurtzite is named after the French chemist Charles Adolphe Wurtz (q.v.).

KENNETH W. PERKINS.

**WÜRZBURG**, wŭrts'boörkh, city, Germany, capital of Lower Franconia in northern Bavaria, on the Main River about 60 miles southeast of Frankfurt am Main. It is a commercial, industrial, and educational center, and a river port. The chief industry is the manufacture of printing machines; there are also breweries and firms engaged in bridge and railroad construction, and wine growing is important in the vicinity. The university (Julius-Maximilians-Universität) evolved in 1582 from a Jesuit college established in 1567, and remained a Jesuit school until 1773; its medical school won fame in 1895 with the discovery of X-rays by Wilhelm Conrad Roentgen. Towering above the city is the Marienberg Castle (1201). Most of the old buildings of the city were destroyed or badly damaged in the air attack of March 16, 1945, which gutted 85 percent of the city, including the Romanesque cathedral (consecrated 1189), the 11th century Neumünster Church, and part of the Residenz (the 312-room bishop's palace built in 1720-1744, one of Europe's foremost baroque structures). The university was heavily damaged but has been reconstructed.

The first documented mention of Würzburg dates from 704. Ruled by its bishops from 741, it developed as a city during the 10th and 11th centuries. The minnesinger Walther von der Vogelweide died here about 1230 and is buried in the cloisters of the Neumünster. The Hohenstaufen emperor Frederick I Barbarossa was married in Würzburg in 1156, and the city was the site of several imperial diets. In 1631, during the Thirty Years' War, the Swedish king Gustavus II Adolphus conquered the city. With the Peace of Lunéville (1801), Würzburg was secularized, and it came under Bavarian control in 1803. In 1805, by the Treaty of Pressburg, it was made an electorate and grand duchy under Ferdinand III of Tuscany, but it was returned to Bavaria in 1815. Following World War II, it was included in the Federal Republic of Germany (West Germany). Pop. (1961) 116,900.

**WUSIH** or **WU-HSI**, wŭ'shē', municipality, China, in southern Kiangsu Province, north of Lake Tai, on the Grand Canal and the Shanghai-Nanking Railway, 26 miles northwest of Soochow. The city is a cotton-, rice-, and flour-milling center; it also has machinery- and needle-manufacturing and oil-pressing industries. It was industrialized during the late 19th century and took over some of the textile-manufacturing functions of Soochow. Previously it had been a walled market town. Pop. (1957) 613,000.

NORTON S. GINSBURG.

**WUTHERING HEIGHTS**, wŭth'ər-īng hits, the only novel by Emily Brontë, published in 1847 under the pseudonym of Ellis Bell (see BRONTË, CHARLOTTE, EMILY, and ANNE). Though almost a complete failure with both the public and the critics, it was reissued in 1849 with an introduction by Emily's more famous sister, Charlotte, author of *Jane Eyre*. *Wuthering Heights* is a be-

lated and unconventional specimen of the so-called Gothic romance or novel of terror, inaugurated by Horace Walpole's *Castle of Otranto* (1764). Its scene is a bleak mansion on the Yorkshire moors, the home of the Earnshaw family, into which the foundling Heathcliff is introduced after being picked up by Mr. Earnshaw on the highroad. The story deals with the fiercely revengeful life of Heathcliff, who develops, under ill usage and neglect, an appalling cruelty, coupled with an inflexible will and a strange power of fascination. He gains control of the Earnshaw property and brings up Hareton, son of the besotted Hindley Earnshaw, whom he hates, in brutal ignorance. The one redeeming trait in his distorted and satanic nature is his wild love for Hindley's sister, Catherine, which outlives both her marriage to Edgar Linton and her death. Thwarted by Catherine's daughter in his endeavor utterly to debase Hareton Earnshaw, Heathcliff starves himself to death, haunted and exhilarated by the spectral presence of the woman who, despite his cruelty (of which she herself felt the effect during her life), has always belonged to him in spirit.

The story is a wild and passionate one, far remote from real life, which Emily Brontë knew scarcely at all. Scenes of domestic violence succeed one another in a way that is almost too much for the reader's nerves. The characters are the creation of a lawless but extraordinarily vivid imagination, and the whole novel is written with an energy that triumphs over the obvious limitations of its author's art.

JAMES H. HANFORD

**WUTUNGKIAO** or **WU-T'UNG-CH'IAO**, wŭ' tŭng'ch'you', municipality, China, in south central Szechwan Province, on the east bank of the Min River, 15 miles southeast of Loshan. It is a center of salt production. Pop. (1953) 199,100.

NORTON S. GINSBURG.

**WYANDOT INDIANS**, wī'an-dŏt, or **HURON INDIANS**, hŭr'ŏn, a confederation of North American Indian tribes. The name Huron is an Old French word meaning "a person with bristly unkempt hair" and was first given to the confederation by the French in the early 17th century. The Indians called themselves Gendat o Wendat (Wyandot), signifying "island or peninsula dwellers." A loose confederacy of Iroquoian speaking tribes, they occupied in 1615 the territory known as Huronia, with villages concentrated at the southern end of Georgian Bay and Lake Simcoe in what is now Ontario, Canada. Father Jean de Brébeuf said that they had 24 villages and a total population of 30,000, which included the Bear people (Attignauquantan), Cord people (Attigeenongnahac), Rock people (Arendahronon), and Deer people (Tohontaenrat). An agricultural people with social, political and ceremonial institutions similar to those of the Iroquois, the Huron-Wyandot grew by adopting whole populations. They allied themselves early with the French against the Iroquois League (q.v.). The Iroquois wars, smallpox, and other communicable diseases introduced by the white man destroyed their confederacy by 1650. Several hundred survivors who wintered at Quebec (1649) were given refuge by the Fi In 1693 Father Pierre Joseph Marie Chau built a chapel near Quebec dedicated to Santa Casa of Loreto, Italy; the descendants of

10 Huron survivors living in Loretteville near his chapel have since been known as the Huron of Lorette. Most of the other Huron were adopted by members of the Iroquois League, and in 1653 Father Simon Le Moine said that there were more than 1,000 Christian Huron living with the Onondaga.

The Huron who sought refuge with the Erie shared their defeat (1653-1656) and were adopted by the league members or dispersed. Some of those given refuge by the Tionontati (Tobacco) escaped the wrath of the Iroquois by fleeing westward. After suffering many hardships in Michigan and Wisconsin, they were befriended by the Potawatomi and the Ottawa and allowed to settle among them. Fathers Claude Allouez (1665) and Jacques Marquette (1669) noted the vicissitudes and wanderings of these Huron, who became known as Wyandot. During the 18th century most of them had moved to the vicinity of what is now Sandusky, Ohio, and after the peace of 1815 land in Ohio and Michigan was granted them by the United States. In 1819, however, they sold all their land except the territory near the upper Sandusky River and a small section near Detroit, where they lived until they moved to Kansas in 1843. The treaty of 1855 conferred citizenship on them but resulted in forced land sales. In 1859 the Seneca-Cayuga gave the homeless Wyandot 13,000 acres of their reservation in Oklahoma, reciprocating the hospitality which the Wyandot had extended in 1817 when the Seneca-Cayuga were themselves homeless. The agreement between the tribes was confirmed by a treaty with the United States in 1867, whereby the Wyandot received 20,000 acres. In 1871 the Wyandot tribal organization was restored, and they were placed under the jurisdiction of the Quapaw Agency, Oklahoma. In the mid-1950's the Huron-Wyandot in Oklahoma numbered approximately 894; those in Quebec, about 800.

See also IROQUOIS INDIANS.

GEORGE S. SNYDERMAN.

**WYANDOTTE**, wí'an-dót, city, Michigan, in Wayne County, on the Detroit River, 11 miles southwest of Detroit. It is an industrial center noted especially for its chemical products, which are derived from the vast salt beds underlying the area. Some of the products manufactured are chlorine gas, dry ice, soda ash, plastics, spark plugs, paint, automobile parts, brass fittings, metal wheels, cleaning compounds, dairy products, and beverages. From 1872 until 1920 Wyandotte was a major shipbuilding center for the Great Lakes. Iron manufacturing developed here in the mid-1850's, and a blast furnace constructed in 1864 produced the first commercial Bessemer steel in the United States. The city is named after the Wyandot Indians, from whom the area was obtained in 1818. It was incorporated as a city in 1867. Government is by mayor and council. Population: 30,938.

EDWINA DEWINDT.

**WYANDOTTE CAVE**, a natural limestone cavern in Indiana, situated in Crawford County, 25 miles west of New Albany. Discovered in 1798, it was used as a source of saltpeter until 1850, when it was opened to the public. Its 5 levels have been explored for 23 miles. Some of its chambers are 350 feet long and 180 feet high. Places of interest include Monument Mountain, 175 feet high, and

the Pillar of the Constitution, a stalagmite 75 feet in circumference.

**WYANT**, wí'ant, **Alexander Helwig**, American landscape painter: b. Evans Creek, Ohio, Jan. 11, 1836; d. New York, N.Y., Nov. 29, 1892. In his youth he was apprenticed to a harness maker, but in 1857 he saw some paintings by George Inness and decided to become an artist. With assistance from Nicholas Longworth and others, he studied in New York City and in Europe, where he became a pupil of Hans Gude at Karlsruhe in 1865. He first exhibited at the National Academy of Design, New York City, in 1864 and was elected to membership in 1869. While he maintained a studio in New York, he spent his summers in the Adirondack and Catskill mountains, and he is best known as a painter of poetic scenes of woods and valleys. His mature landscapes are distinguished by their subtle coloring and portrayal of light and shadow under changing skies. Among his works are *In the Adirondacks*, *The Mohawk Valley*, and *Clearing After Rain*, Metropolitan Museum of Art, New York City; *The Connecticut Valley* and *Landscape*, Corcoran Gallery of Art, Washington; *Passing Clouds* and *Moonlight and Frost*, Brooklyn Museum; and *In the Still Forest*, Worcester Art Museum.

**WYATT**, wí'at, **Sir Francis**, British colonial governor in America: b. Kent, England, 1588; buried Boxley, Kent, Aug. 24, 1644. The great-grandson of the poet Sir Thomas Wyatt (q.v.), he was married in 1618 to a niece of Sir Edwin Sandys. Through this connection he became in 1620 an investor in the Virginia Company and in the following year was chosen governor of Virginia. He arrived in the colony in October 1621, bringing with him a new constitution. His term of office was marred by the Indian massacre of 1622, but he was a successful and popular administrator. After the company was dissolved in 1624, he served as the first royal governor until 1626, and is remembered especially for his ultimately successful effort to preserve representative government in the colony. He was governor of the colony again in 1639-1641.

**WYATT**, **James**, English architect: b. Burton Constable, Staffordshire, England, Aug. 3, 1746; d. near Marlborough, Wiltshire, Sept. 4, 1813. He was taken to Rome about 1760 by the 1st Baron Bagot, and for the next six years studied architecture there and in Venice. Returning to England in 1766, he attracted notice with his designs for the Pantheon (1772), a fashionable London meeting place until its destruction by fire in 1792. In 1796 he was appointed surveyor general to the Board of Works. Besides numerous private commissions, of which the most famous was the neo-Gothic Fonthill Abbey (1795), he designed the Royal Military Academy, Woolwich (1796) and did much work for George III at Windsor. About 1782 he abandoned the Graeco-Italian style of his early buildings for the Gothic, which he was one of the first architects to revive. Because of the ruthlessness with which he removed Renaissance additions in restoring Salisbury, Lincoln, Hereford, and other cathedrals, he was called "the Destroyer," but this view of his work is not justified.

**WYATT**, **Sir Thomas**, English poet: b. Allington Castle, Kent, England, 1503; d. Sherborne, Dorset,



Oct. 11, 1542. Evidence that he received an M.A. degree at Cambridge has been disproved. He married Baron Cobham's daughter, Elizabeth Brooke, who became the mother of his son Thomas (see WYATT, SIR THOMAS, 1521?-1554) and a daughter. Already known at the court of Henry VIII, he found employment there, participated in the Christmas 1525 tournament before the king, and the following year served on a diplomatic mission to France. In 1527 he was sent to Italy, where the Spanish captured and held him for ransom, but he managed his own escape. The next few years he was marshal of Calais. He returned to England, became commissioner of the peace for Essex, and in 1533 officiated at the marriage of Henry VIII and Anne Boleyn, whom he may have known most of his life and whose lover he was reputed to be. He lived only a few years with his wife, who had been unfaithful.

Wyatt had great intellectual gifts, but there is evidence that he was restless and impetuous. He was imprisoned briefly in 1534 and again in 1536, the latter instance involving differences with Charles Brandon, duke of Suffolk. Popular opinion has built a tradition that he continued intimate relations with Anne after she became queen and was implicated in her downfall in 1536, but evidence is lacking. He had probably been knighted the previous year, but the king made him sheriff of Kent a few months later and the next spring appointed him ambassador to Spain. He served on a special mission to France and the Netherlands in 1539, returning to witness the execution of his friend and protector Thomas Cromwell in July 1540. His enemies plotted his downfall the following January on charges of treason, but his usual honesty, courage, and eloquence prevailed. His dramatic defense was circulated in manuscript and discomfited his accusers. New honors were bestowed upon Wyatt, and he was on a special mission to Falmouth to escort Spanish envoys when he caught fever and died.

Wyatt was the first of the great Tudor poets who, within the span of a single century, elevated English verse from obscurity to the first ranks of world literature. Like Chaucer he probably came in direct contact with French and Italian poets through diplomatic service, and he introduced new verse forms into English. Much of his experimental verse is translated or adapted from foreign sources, particularly Italian, but most of his best poems are original and some of them deeply personal. He introduced and popularized the sonnet in English and wrote a few excellent rondeaus and epigrams such as *What No, Perdie; Tagus, Farewell*; and *Lux, My Fair Falcon*. Using *terza rima* as a new English verse form adapted from the Italian, he wrote three satires and seven penitential psalms which were widely acclaimed, but it was in the simple and more native tradition of the song form that he found enduring greatness as a poet. *Forget Not Yet; Blame Not My Lute; My Lute, Awake*; and *In Eternum* represent Wyatt at his best.

His sonnets contain Petrarchan conceits characteristic of the Elizabethans, but not their mellifluous meters; yet most of his songs have the simple sincerity and rhythmic skill of the lover and musician that legend has made him. A deeply serious nature is revealed in the satires and psalms and in the prose of two letters to his son and the defense prepared for his trial. The poet and the man become inseparable, for like Sir Philip Sidney he seemed a fulfillment of the Renaissance ideal—

soldier and statesman, courtier and lover, scholar and poet.

Most of Wyatt's poems were preserved in manuscript collections. *Certain Psalms* was published in 1549 by Thomas Raynald and John Harrington, and 97 poems attributed to him were printed in Tottel's miscellany entitled *Songs and Sonnets* (1557).

WILLIAM BRACY,  
Humanities Editor, "The Encyclopedia Americana."

**WYATT, SIR Thomas** (called **THE YOUNGER**), English soldier: b. ?1521; d. London, England, April 11, 1554. Son of the poet and diplomat Sir Thomas Wyatt (q.v.), he served with the English Army in France from 1543 to 1550. In 1554 Edward Courtenay, earl of Devonshire, invited him to help raise a general insurrection to prevent the marriage of Mary I with the future King Philip II of Spain. Wyatt alone avoided arrest and marched on London with some 4,000 men in what came to be known as Wyatt's Rebellion. His army melted, however, before the queen's forces, and Wyatt was taken prisoner. He could offer no defense at his trial and was beheaded for treason. On the scaffold he exonerated the future Elizabeth I, whom Mary's supporters had hoped to implicate in the conspiracy.

**WYCHERLEY**, wích'ər-lē, **William**, English dramatist: b. Clive, Shropshire, England, May 28, 1641, d. London, Jan. 1, 1716. At the age of 15 he was sent to France to be educated, but spent his time in the salon of the duchesse de Montausier, daughter of the famous marquise de Rambouillet, learning foppish habits. He also became a Roman Catholic. When he returned to England, his father sent him to Queen's College, Oxford, to undo the French education, but Wycherley left the university in 1659, without having earned a degree, and went to London, where he entered the Inner Temple to study law.

The fashionable world of London proved more attractive to Wycherley than his law studies, and by 1671 he had written his first comedy, *Love in a Wood, or St. James's Park*. It earned him the attention of the court wits and introduced him to a life of excitement which only death would still. He became the lover of Charles II's mistress, Barbara Villiers, duchess of Cleveland, and in 1680 married the beautiful widowed countess of Drogheda, who died soon after, leaving him a fortune which he lost in lawsuits over the inheritance. He then spent three years in debtor's prison until James II paid his debts and gave him an annual pension, which was withdrawn at the Revolution of 1688. Wycherley inherited his father's estate in 1689 but was forbidden by entail to sell any of it. Finally, 11 days before his death, and at the age of 75, he married a young woman, Elizabeth Jackson, at the insistence of his cousin Thomas Shrimpton, who married the young widow very soon afterward in order to share the inheritance from Wycherley's estate that she had received on Wycherley's death.

Wycherley's development as a dramatist showed a steady advance. His first comedy had no central theme, but his second, *The Gentleman Dancing-Master* (1672), satirizes the "masquerading Age" which saw reality as pretense and pretense as reality. His third comedy, *The Country Wife* (1675), is his masterpiece, and to many readers it is the best of the great come-

lies of the Restoration. The play again satirizes false appearances, but at the same time it presents an ideal way of life not subjected to satire. In 1676 Wycherley's last and most profound comedy was produced, *The Plain-Dealer*, based upon Molière's *Le misanthrope*. Manly, the protagonist, dupes himself as his rage for sincerity drives him to search for the ideal in a world of pretense and corruption. The play transcends its immediate period and attains the level of universal satire.

DONALD B. CLARK

Professor of English, University of Missouri

**WYCKOFF**, wī'kôf, township, New Jersey, in northwest Bergen County, 10 miles by road north of Paterson. The name is derived from the Indian *wikhoff*, meaning "high ground." The township is predominantly residential, with the majority of the working population commuting to nearby metropolitan centers, such as Paterson and New York.

The first inhabitants of the area were Leni-Lenape Indians. Dutch settlers from New York City established a farming community on that location in 1720, and the township still bears the imprint of these early residents in the architecture of its oldest houses, many of which have been continuously occupied for over two centuries. The Wyckoff Reformed Church, built in 1806, is one of the oldest in New Jersey.

The present township was originally part of a larger tract incorporated in 1771 as Franklin Township, which in 1922 was divided into smaller parcels, one of them taking its name from the village of Wyckoff. The government is conducted by a committee of five members, of whom the chairman holds the honorary title of mayor. Pop. 15,500.

WILLA BUSSOM

**WYCLIFFE**, wī'klif (also WICLIF, WYCLIF, or WICKLIFFE), John, English religious reformer: b. near Richmond, Yorkshire, England, c. 1320; d. Lutterworth, Leicestershire, Dec. 31, 1384. Member of an old Yorkshire family, he entered Balliol College, Oxford, in 1344 and later (sometime between 1356 and 1360) became its master. Although his first inclination was scientific and philosophical, he also studied theology and canon law, as well as local history. From 1365 to 1367 he was warden of Canterbury Hall in Oxford, a duty he presumably performed in addition to his duties at Balliol. He became a doctor of theology in 1372. His lectures were popular and well attended, and he was widely known for his gift as a preacher. In 1374, by favor of the king, he became rector of Lutterworth, a position he held for the rest of his life; meanwhile, he continued lecturing at the university.

**Ecclesiastical Reform.**—Also in 1374 Wycliffe was one of the royal envoys sent to confer with papal representatives at Bruges on the subject of provisions—papal appointments to ecclesiastical posts before they became vacant. Perhaps in part as a result of this experience, he became involved (in 1376) in the movement that sought to achieve ecclesiastical reform. At least it appears that his political, not his theological, views led him to oppose and to criticize the papal system, especially its methods of appointments, fees, and taxation.

The Good Parliament of 1376 was already endeavoring to correct ecclesiastical abuses. Wycliffe's

views at this time were far from radical, but gradually he became convinced, largely by his Biblical studies, that the church was not what it should be, and that it must be brought back to apostolic purity of life and doctrine. The possession of secular power by the clergy was incompatible with true religion and the teaching of the Saviour. The conclusion that papal control of the English church and its financial levies must end was only one of the inferences that he began to draw from this newly adopted principle. Protected by his patron, John of Gaunt, duke of Lancaster, he now issued a series of pamphlets which advocated, among other things, the position that it was the duty of the state to intervene and take control of the church's properties in the interest and benefit of the poor. (Many of the church's endowments had been bequeathed for that specific purpose.)

Both the nobility and the middle class readily accepted this principle, but the bishops and the well-endowed religious orders vigorously objected. Wycliffe was cited to appear before the bishop of London on Feb. 19, 1377. He was accompanied by a group of mendicant monks who promptly rioted, and the meeting came to nothing. Meanwhile, the pope, Gregory XI, issued 5 bulls condemning 18 of Wycliffe's "conclusions" and summoned him to appear before a papal court; but neither the government nor Oxford University was willing to hand him over to an ecclesiastical trial. His enemies hoped that he would become entangled in political toils, but Wycliffe had the support of members of the royal family; moreover, the king, Edward III, died that year. The following year (1378), Wycliffe was summoned to Lambeth Palace in London to make an appearance before the archbishop of Canterbury. The result was another tumult. As a consequence, Wycliffe summarized his teaching in 33 statements and prepared himself to defend his controversial views at Rome, but before he could set out on the journey, the pope died.

**Translation of the Bible.**—Wycliffe now began writing about "the Law of God," by which he meant the Bible, as distinguished from papal pronouncements and traditions. He inferred that the true church is one and indivisible, with Christ as its only Head, not the pope: the Babylonian captivity of the popes at Avignon (1309–1377) had undermined popular confidence in papal authority. The true apostolic church, he held, is not to be identified with the visible institution, but is made up of the elect, who have been predestined to be its members. Salvation depends upon predestination and grace rather than upon baptism and membership in the visible church. Another inference was "the priesthood of all believers" rather than the succession of validly ordained ministers. Royal power derives from God, for the purpose of protecting the weak and administering justice, and must be accounted for on the Last Day. Hence the clergy must obey the law of the land and the orders of the sovereign: the king is their superior in all civil matters, and they hold their "temporalities" by his consent. Even the pope cannot dispense from this rule. The pope deserves reverence only when he lives and acts in a Christlike manner—the church can exist without him. As the Bible is the Christian's law, it must be made known in the vernacular. Wycliffe began the first complete translation into English, a task in which he had the help of Nicholas Hereford and John Purvey. He also sent out itinerant

preachers ("poor priests," that is, seculars, not mendicants or regulars), who were to live among the people and preach the Gospel, not as rivals of the parish clergy but as supplementers of their work. Most of these preachers were Oxford men.

**Forerunner of the Reformation.**—Eventually, Wycliffe attacked transubstantiation (q.v.), and his sacramental teaching was denounced by the Oxford authorities in 1381 as heretical. Wycliffe appealed not to the pope, but to the king. That year saw the Peasants' Revolt and a consequent reaction among all conservatives in church and state against radical views such as those of Wycliffe. The mendicants turned against him, and the Earthquake Synod (so called because an earthquake took place during its sessions) in London called upon the state to extirpate the false teaching. But the House of Commons refused to act. In his teaching, Wycliffe had condemned auricular confession, absolution, confirmation, orders, unction, celibacy, the "power of the keys," veneration of statues and relics, invocation of saints, pilgrimages, masses for the dead, the doctrine of purgatory, and other traditional teachings and practices of the church. This earned for him the later title of Morning Star of the Reformation, and his influence is clearly to be traced in Jan Hus and others all the way to Martin Luther and John Calvin. Even more important was the power he attributed to the state in its relation to the church, and his view of predestination and the invisible nature of the true church.

Modern scholars tend to emphasize the importance of the social and political background of Wycliffe's views. He shared the 14th century reaction against tradition and the increasing nationalism and secularism of the time. Such thinkers as Marsilius of Padua and William of Ockham had prepared the way for his political and ecclesiastical views. Wycliffe was a staunch follower of Thomas Aquinas but was influenced by later trends. Lordship, he held, was distinguished from possession, as a stewardship under God. Property is the result of sin: Christ and the apostles had none. Wicked men are not entitled to property, and the state must see that they are deprived of it: the clergy and monks must be compelled to live in apostolic poverty. At the same time, Wycliffe was a loyal supporter of the secular power, since human affairs are guided by divine providence (compare Romans 13:1). The church has no concern with temporal affairs. It is strange that Wycliffe was surprised to find his teaching echoed far and wide, and that "every sparrow twittered about it."

See also BIBLE—17. *History of the English Bible*; LOLLARDS.

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**WYE RIVER**, wī, river, Wales and England, about 135 miles long. It rises on the slopes of Plynlimon (2,468 feet) in west-central Wales, flows south-east past Rhayader and Builth Wells, and enters England at Hay. It then turns eastward to Hereford, whence its course is southward by Ross and Monmouth to Chepstow, 2½ miles beyond which it enters the estuary of the Severn. Its principal tributaries are the Elan, Ithon, Yrfon, Lugg, and Monnow.

The Wye is distinguished for the variety and beauty of its scenery, particularly in its lower reaches, two noteworthy points being the ruined Tintern Abbey (q.v.) and the extraordinary loop between wooded hills at Symond's Yat. Boating is possible over short stretches of the river at Hereford, Ross, Monmouth, and Chepstow, but in general is prohibited by weirs, rocks, and a fast current. The effect of the Severn tide (which rises 46 feet at spring tides) is felt as far as Bigsweir, 9 miles above Chepstow.

H. GORDON STOKES.

**WYETH**, wī'əth, Andrew (1917– ), American painter, who is probably the best known, and certainly the most beloved 20th century American artist. In the sense that he belongs to no group or school and has worked far from the centers of artistic activity, Wyeth is a solitary, but in tastes, tradition, and training he is completely American. Wyeth finds his subject matter entirely in the two regions in which he lives—the rural countryside of his winter home at Chadds Ford, Pa., and the seashore, islands, and bleak houses around Cushing, Me., where he spends his summers. Because of their familiarity, the simple, often somber landscapes and the unpretentious spare people of his paintings appeal immediately. At first glance he seems to have recorded with precise accuracy. Actually, however, every composition is transformed by a pervasive poetic vision that tempers exactitude without deforming either the subject or the setting.

The subtle symbolism of Wyeth's paintings and its quiet import are revealed only on slow examination. Modest in scale, reflective in theme, admirable in craftsmanship, Wyeth's work speaks of universal experience. The people he depicts are self-contained and self-sustaining. Their austere world is recorded in browns, russets, tans, and deep greens that are almost black, enlivened by touches of bright geranium red or clear, light blue. Fields and forests, sky, wind, and the sea, the hunter and the hunted, life and death and life again—these are Wyeth's themes.

**Early Life.**—Andrew Wyeth was born on July 12, 1917, in Chadds Ford, Pa., the youngest of the five children of the well-known artist and illustrator Newell Convers Wyeth (q.v.). Because he was not of robust health, Andrew was educated at home by his parents. He received his art instruction from his gifted father, who gave him a thorough grounding in anatomy, trained his powers of observation, and disciplined his visual memory. Among his earliest works are some pen-and-ink drawings made at the age of 12 for a book illustrated by his father. Some of Wyeth's Negro neighbors of Chadds Ford, Pa.

*Christina's World* (1948) is one of Andrew Wyeth's best-known works.

Collection, The Museum of Modern Art, N.Y.



miliar figures in his adult paintings, first appeared in his earliest watercolor drawings.

Between 1924 and 1926 the New Mexico artist Peter Hurd studied with Andrew Wyeth's father, and it was Hurd who taught young Wyeth the demanding tempera technique. At 16, Wyeth first saw the work of Winslow Homer and discovered a kindred spirit. At the age of 20 he had his first one-man show, entirely of watercolors, at the Macbeth Gallery in New York, and every painting was sold. If there seemed to be some influence of Winslow Homer in the choice of outdoor subjects, each watercolor was authentically personal in its tonality and in its transcription of air and light. Although Wyeth continued to make watercolors and what he called "dry brush drawings," he gradually turned more and more to tempera for his paintings.

**Mature Paintings.**—Andrew Wyeth's father was killed in 1945 in a car accident, and his first tempera after this sad event was a turning point for the artist. *Winter 1946* (1946; private collection, Cambridge, Mass.) is a picture filled with haunting overtones. It represents a young boy, dressed in a World War II uniform, running down a barren hill edged by traces of snow, his long thin shadow beside him. The picture is filled with a sense of sadness and of loneliness.

Often an event in daily life, sharpened by a sudden revelation of private heartache, gives Wyeth a subject for a painting. Through sketches and drybrush drawings he works out the composition, and it was in this way that Wyeth's best-known painting, *Christina's World* (1948; Museum of Modern Art, New York) came into being. Wyeth saw his neighbor, Christina Olson, a woman crippled by poliomyelitis, picking berries in the grass near her family burying ground. She paused to look up to the family home on the hill, a large empty-looking house. One need know nothing of Christina to feel the drama that haunts the scene.

In *Distant Thunder* (1961; private collection, New York), only the dog is alert to the rumbling of the coming storm, the berry picker sleeps gently on. The title, brilliantly chosen for this particular painting, could also serve symbolically for many others. Even in Wyeth's most quiet scenes, a similar ominous force is often suggested—by great boots tramping, hawks circling

slowly above barren hills, empty milk pails up-ended, quiet fog rolling in from the sea, a stiff dead deer swinging in the winter wind, or an empty rocking chair in a lovely landscape.

The so-called Helga Pictures, 240 drawings and paintings of a neighbor of Wyeth, date from the years 1971–1985. They were revealed to the public in 1986.

AGNES MONGAN\*, *Fogg Art Museum*

**WYETH, Newell Convers**, American painter and illustrator: b. Needham, Mass., Oct. 22, 1882; d. near Chadds Ford, Pa., Oct. 19, 1945. After studying art in Boston, he went to Chadds Ford, Pa., to study with the illustrator Howard Pyle. Wyeth became one of America's most noted illustrators, achieving an even wider reputation than his teacher. Among some 20 juvenile classics that he illustrated are *Treasure Island* and other books by Robert Louis Stevenson, adventures of Robin Hood and King Arthur and his knights, Jane Porter's *The Scottish Chiefs*, James Boyd's *Drums*, and Marjorie K. Rawlings' best seller, *The Yearling* (1939 edition).

Wyeth was equally active as a mural painter and executed commissions for hotels, banks, churches, and other buildings. These include Civil War battle scenes for the Missouri State Capitol; a triptych for the Hotel Roosevelt and panels for other buildings in New York City; and murals in Boston, Washington, and other Eastern cities. He also painted scenes from country life in egg tempera. Among his numerous pupils were his son Andrew Wyeth (q.v.), his daughter Henriette, and Peter Hurd, who became a son-in-law.

FREDERICK A. SWEET.

**WYKEHAM, William of.** See WILLIAM OF WYKEHAM.

**WYLD, wild**, Henry Cecil Kennedy, English philologist and lexicographer: b. London, England, March 27, 1870; d. Alvescot, Oxfordshire, Jan. 26, 1945. Educated at Bonn, Heidelberg, and Oxford universities, he became first Baines professor of English language and philology at the University of Liverpool in 1914, was Merton professor of English language and literature at Oxford from 1920 until his death. His

studies in English phonetics, philology, and historical grammar had great influence. Besides many papers, he published *The Study of Living Popular Dialects and Its Place in the Modern Science of Language* (1904); *The Growth of English* (1907); *A Short History of English* (1914; 3d ed., 1927); *A History of Modern Colloquial English* (1920; 3d ed., 1936); and *Studies in English Rhymes* (1923). His work as editor of *The Universal Dictionary of the English Language* (1932) was distinguished for its complete etymologies and original illustrative sentences.

**WYLIE, wī'lē, Elinor Morton** (née Hoyt), American poet and novelist: b. Somerville, N.J., Sept. 7, 1885; d. New York, N.Y., Dec. 16, 1928. She was educated at the Baldwin School, Bryn Mawr, Pa., and the Holton Arms School, Washington, D.C., and in 1905 married Philip Hichborn. In 1910 she eloped with Horace Wylie, to whom she was married in 1916. The Wylies were divorced in 1923, and she then married William Rose Benét (q.v.), the poet and critic.



Elinor Wylie

Alfred A. Knopf

Elinor Wylie's work consists in the main of eight books—four novels and four volumes of verse—in which she made wide use of the lore of history and literature. Well acquainted with Scotch, Irish, and English ballads, she liked to sing them, as well as her own verses, which she set to tunes that she made up herself. Her first novel, *Jennifer Lorn* (1923), was immediately recognized as possessing a rare and delicate satire, particularly of those qualities in men that make them attractive to women and at the same time objects of railery. *The Venetian Glass Nephew* (1925) is a fable of the marriage of Christian art and pagan nature. *The Orphan Angel* (1926) relates the fantasy that the poet Percy Bysshe Shelley was rescued by an American ship instead of drowning. Shelley's subsequent adventures on the rough American frontier give Mrs. Wylie scope for witty and sensitive analysis of both the poet and the times. In *Mr. Hodge and Mr. Hazard* (1928), she deals with the England that has rejected Shelley, turning her irony upon the historical roots of contemporary mores.

In her verse, which includes *Nets to Catch the Wind* (1921), *Black Armour* (1923), *Trivial Death* (1928), and the posthumous *Angels and Earthly Creatures* (1929), Elinor Wylie is an extraordinarily refined artist and shows the influence of the ballad writers, the Elizabethans, and the metaphysical poets. Perhaps her favorite sub-

ject is the reality that underlies convention. In *Beauty*, for example, she writes of a quality that is neither good nor wicked:

O, she is neither good nor bad,  
But innocent and wild!  
Enshrine her and she dies, who had  
The hard heart of a child.

More specifically, she often deals with her own personality as it is, rather than as others define it; or she punctures grandiose and glib formulations.

JOHN ASHWORTH,  
Lecturer on Writing, Columbia University.

**WYLIE, i(da) A(lexa) R(oss)**, British author: b. Melbourne, Australia, March 16, 1885; d. Princeton, N.J., Nov. 4, 1959. Soon after she was born, her family moved to England, and her mother died. From her 10th year, her father gave her money to travel unaccompanied through Europe, and until the age of 14 she received no formal education, although she read avidly. By this time she had decided to become an author. After attending schools in Belgium and England, she went to Germany at 19 for further education, remaining 8 years and writing her first published stories. In 1911 she became active in the suffrage movement in England, and in 1917 she visited the United States, where she spent her later years. She never married.

Miss Wylie's fiction frequently deals with themes of political and social import, and her travels provided her with insights into national as well as individual character. *Towards Morning* (1920), her first mature novel, was an outgrowth of her residence in Germany, and *To the Vanquished* (1934) takes place under the rise of Nazism. After a visit to the USSR in 1934, she wrote *Furious Young Man* (1935); its protagonist is a young English convert to communism. *Where No Birds Sing* (1947) is set in Germany under the American occupation. *Candles for Therese* (1951) is about a man's quest for revenge on the betrayer of some resistance fighters during World War II. In *The Undeclared* (1957), her last novel, Miss Wylie's theme is the effort made by members of a guilt-ridden community in postoccupation Provence to exculpate themselves. She also wrote more than 200 short stories, some screen plays, and an amusing autobiography, *My Life with George* (1940), George being her unconscious mind.

**WYLIE, Philip**, American writer: b. Beverly, Mass., May 12, 1902; d. Miami, Fla., Oct. 25, 1971. After spending three years at Princeton University and two years on the *New Yorker* staff, he began a free-lance career writing popular fiction. He was in Hollywood as a script writer for Paramount Pictures (1931-1933) and Metro-Goldwyn-Mayer (1936-1937) and marketed reams of stories and articles in popular magazines such as *Red Book* and the *Saturday Evening Post*. His first novel was *Heavy Laden* (1928) and his last was *The End of the Dream*, published posthumously in 1972. He also wrote science fiction volumes (1932-1936) in collaboration with Edwin Balmer, editor of *Red Book Magazine*; *The Army Way* (1940), in collaboration with William W. Muir; and some anonymous writing.

A special interest in the study of psychology, particularly the work of Carl Jung, motivated Wylie's most successful books: *A Generation of Vipers* (1942), vituperative essays on "momism"



and other American ills; *Essay on Morals* (1947) earnest but iconoclastic; and the novel *Opus 21* which attempts, along with pessimism and ribaldry, an analysis of ills in American society. Some of his later volumes are collections of fishing stories based on the adventures of his popular characters Crunch and Des.

WILLIAM BRACY.

**WYMAN**, wī'mən, **Horace**, American inventor: b. Woburn, Mass., Nov. 27, 1827; d. Princeton, Mass., May 8, 1915. After working for some 15 years as a machinist and draftsman, he became superintendent of the Crompton Loom Works, in Worcester, Mass., soon after 1860 and took out the first of his more than 200 loom and textile machinery patents in 1867. He served as manager of the Crompton firm from 1886 until 1897, when it merged with the company founded by Lucius James Knowles; he then continued with the new Crompton & Knowles Loom Works as vice president and consulting engineer until his death. Wyman did considerable work on box motions, particularly for gingham looms, and laid the groundwork for the application of the bobbin-changing principle to fancy or box looms.

**WYMAN**, Jeffries, American anatomist and ethnologist: b. Chelmsford, Mass., Aug. 11, 1814; d. Bethlehem, N.H., Sept. 4, 1874. He graduated from Harvard College in 1833 and from Harvard Medical School in 1837. After practicing medicine in Boston, he taught anatomy and physiology at Hampden-Sydney College in Virginia (1843-1847) and from 1847 until his death served as Hersey professor of anatomy at Harvard. There he established the Museum of Comparative Zoology, which he did much to expand, and also served (1866-1874) as the first curator of the Peabody Museum of Archaeology and Ethnology. From observations made in New England and on trips to Labrador (1849), Florida (1851-1852), Surinam (1856), and various parts of South America (1858), he acquired much of the information he presented in more than 175 scientific papers. Among these were *Anatomy of the Nervous System of Rana Pipiens* (1853); *An Account of Some of the Kjoekkenmoeddings, or Shell-Heaps, in Maine and Massachusetts* (1867); *Observations and Experiments on Living Organisms in Heated Water* (1867); *Observations on Crania* (1868); and *Fresh Water Shell Mounds of the St. John's River, Florida* (1875).

**WYNANTS** or **WIJNANTS**, vī'nānts, **Jan**, Dutch painter: b. Haarlem, the Netherlands, 1630/1635; d. Amsterdam, buried Jan. 23, 1684. Aside from the fact that he was the master of Adriaen van de Velde and collaborated with Philips Wouwerman, and other painters, little is known of his life, but he produced at least 700 canvases. Most of them are small, highly detailed landscapes, often of dune or forest scenes, in which the human figures and animals are frequently the work of his pupils or collaborators. His paintings are found in all the major European galleries.

**WYNDHAM**, wīn'dəm, **SIR Charles** (original surname **CULVERWELL**), English actor-manager: b. Liverpool, England, March 23, 1837; d. London, Jan. 12, 1919. Like his father, he became a surgeon but by 1862 was acting on the professional stage after establishing a brilliant amateur record. During the Civil War in the United States he

served as a surgeon in the Union Army and also acted in New York City. With his own company he returned to America (1869-1871), where he emerged as an adroit light comedian. His success in *Brighton* (1874) convinced English audiences that Charles Mathews' successor had been found. From 1876 he was the lessee of the Criterion Theatre and subsequently opened Wyndham's (1899) and the New (1903) to round out his theatrical empire, which he ran intelligently and profitably with Mary Moore (1861-1931), his leading lady, who became his second wife in 1916. In later years he also excelled in serious roles, notably in Henry Arthur Jones' last good play, *Mrs. Dane's Defence* (1900). He was most applauded in the name role of T. W. Robertson's *David Garrick* (1886). He was knighted in 1902. His last New York appearance was in 1910.

WALLACE BROCKWAY.

**WYNN**, wīn, **Ed** (original name **ISAIAH EDWIN LEOPOLD**), American entertainer: b. Philadelphia, Pa., Nov. 9, 1886; d. Beverly Hills, Calif., June 19, 1966. By the age of 19 he was a leading Broadway vaudeville performer, and later he was featured in the Ziegfeld *Follies* of 1914 and 1915 and other productions. During the 1920's he appeared in a series of successful Broadway musical shows, producing and writing the music and words for such hits as *Ed Wynn's Carnival* (1920) and *The Perfect Fool* (1921). In 1932 he began a popular radio program as the Texaco Fire Chief, and he returned to Broadway with great acclaim in *Boys and Girls Together* (1940).

Wynn was in his seventies when he started a new career as a dramatic actor in the film *The Great Man* (1957). Afterward he appeared in movies and on television in many character roles, notably the dentist in *The Diary of Anne Frank* (1959).

**WYNTOUN**, wīn'tən, **Andrew of**, Scottish chronicler: b. about 1350; d. after 1420. A canon regular of the priory of St. Andrews, he was elected prior of St. Serf's Inch, Loch Leven, about 1395 and probably held this office until his death. He is known for his *Orygynale Cronykil of Scotland*, in nine books, a metrical account of Scottish history from mythological times to 1408. Although he mixes tradition and history indiscriminately, the later periods are well handled, and the work has considerable philological interest as the earliest chronicle in the Scottish vernacular. It received little attention until 1795, when David Macpherson published part of it. A complete edition of one of the surviving manuscripts was brought out by David Laing (3 vols., 1872-79), and a fully annotated edition of two of the other extant manuscripts was prepared for the Scottish Text Society by François Joseph Amours (6 vols., 1903-14).

**WYNYARD**, wīn'yərd, town, Saskatchewan, Canada, 125 miles east of Saskatoon by rail and 111 miles north of Regina by road. It is a divisional point on the Canadian Pacific Railroad and the center of a large mixed farming area. The town has grain elevators, a flour and feed mill, a milk pasteurization plant, and a cold storage locker. There are tourist resorts at nearby Big Quill Lake. Wynyard was incorporated as a town in 1911. Population: 2,147.

JOHN H. ARCHER.



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Wyoming's scenery blends the spectacular and the placid, such as this isolated high country ranch community.

# WYOMING



State Seal of Wyoming

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**WYOMING**, wi-o'ming, a mountain state of the United States, bordered on the north by Montana, on the east by South Dakota and Nebraska, on the south by Colorado and Utah, and on the west by Utah, Idaho, and Montana. It extends 365 miles (587 km) from east to west and 276 miles (444 km) from north to south. Its name, applied originally to the Wyoming Valley of Pennsylvania, is thought to be derived from the Delaware Indian word *mecheweami-ing*, meaning "at the big plains."

The state has few people, little industry, and no large cities. Much of its area has been devoted

## INFORMATION HIGHLIGHTS

**Location:** Wyoming is a mountain state bordered on the north by Montana, on the east by South Dakota and Nebraska, on the south by Colorado and Utah, and on the west by Utah, Idaho, and Montana.

**Elevation:** *Highest point*—Gannett Peak, 13,804 feet (4,210 meters); *lowest point*—Belle Fourche River, 3,100 feet (946 meters); *approximate mean elevation*—6,700 feet (2,044 meters).

**Total Area** (land and inland water): 97,809 square miles (253,326 sq km); rank, 9th.

**Resident Population:** 453,588 (1990 census). Increase (1980–1990), –3.4%.

**Climate:** Cool and dry, with wide daily temperature ranges possible. Little rainfall.

**Statehood:** July 10, 1890; order of admission, 44th.

**Origin of Name:** May be from a Delaware Native American word, *mecheweami-ing*, which means "at the big plains."

**Capital and Largest City:** Cheyenne.

**Number of Counties:** 23.

**Principal Products:** *Manufactures*—petroleum and coal products, food products, flight instruments and flight testing equipment; *farm products*—cattle, livestock, feed, potatoes, beans, sugar beets, poultry, dairy products, honey; *mining*—petroleum, uranium, coal, bentonite, soda ash, iron ore, sand, stone, gravel.

**State Motto:** Equal Rights.

**State Song:** *Wyoming*.

**State Nicknames:** Equality State; Wonderful Wyoming.

**State Bird:** Meadow lark.

**State Flower:** Indian paintbrush.

**State Tree:** Cottonwood.

**State Flag:** The state seal on the ribs of a white bison, centered on a dark blue field with a white border, the whole within a red frame. See also **FLAG**—*Flags of the States*.

to ranching and the  
Tourists are attracted  
national forests and Yellowstone National Park,  
and its mountain scenery and trout-fishing  
streams.

### 1. The Land

The Great Plains end and the Rocky Mountains begin in Wyoming. Between the rugged peaks of its mountainous terrain are treeless basins, dotted with weathered rock towers called buttes. The most famous of these, Devils Tower, became the first national monument in the United States. The unspoiled natural beauty of Wyoming has changed little since the frontier days of cowboys and Indians. Vast ranches, national forests, recreation areas, and parks occupy most of the sparsely populated land that averages more than 6,000 feet (1,830 meters) in elevation.

**Physical Features.** Wyoming is a state of high plains, mountains, and occasional badlands. The Great Plains of the eastern section rise gradually to the foothills of the Rocky Mountains, and the Continental Divide crosses the state from the northwest corner to the southern border east of center. There are many high plateaus with elevations between 4,500 and 7,500 feet (1,370-2,285 meters). In the southeast the Laramie Mountains rise over 10,000 feet (3,050 meters), and the Medicine Bow Mountains reach 12,005 feet (3,660 meters) in Medicine Bow Peak. The Bighorn Mountains in the north central section rise to 13,165 feet (4,000 meters) in Cloud Peak. In the northwest the Absaroka Range culminates in Francis Peak (13,140 feet or 4,480 meters), and the Teton Range in Grand Teton (13,766 feet or 4,195 meters). Gannett Peak (13,785 feet or 4,200 meters), the highest mountain in the state, is in the Wind River Range, which includes numerous other peaks over 13,000 feet (3,960 meters) in elevation.

**Rivers and Lakes.** Wyoming is the source of water for four major drainage systems in the United States—the Missouri-Mississippi; the Interior, or Great Basin; the Columbia; and the Colorado. Most of the drainage is to the north and east into the Missouri-Mississippi system. The tributaries of the Missouri River are the Yellowstone, Clark Fork, Bighorn, Tongue, and Powder rivers flowing north, and the Cheyenne, Niobrara, and North Platte flowing east. The Green River is the major source of the Colorado River. The Snake River is joined by the Salt River and flows into the Columbia. The Bear River, part of the Interior Basin system, flows along the western border of the state into the Great Salt Lake in Utah.

Wyoming has many small, clear mountain lakes, the largest of which are Yellowstone, Jackson, Fremont, and Shoshone. Reclamation projects provide many smaller bodies of water and such man-made lakes as Pathfinder, Seminole, Glendo, Boysen, Alcova, Buffalo Bill, Guernsey, and the huge reservoir on the Green River created by the Flaming Gorge Dam in Utah.

**Climate.** Wyoming's climate is cool and dry, the dryness serving to temper the coldness of the winters. Because altitudes range from 3,100 feet to over 13,000 feet (945-3,960 meters), local variations are considerable, but Cheyenne may be taken as having a typical Wyoming climate. Because of its 6,131-foot (1,870-meter) elevation, the city is subject to a daily range in temperature averaging 25° F and reaching as much as 40°.

This wide range assures the city of moderately warm days and cool nights during the summer months. Cheyenne has a mean temperature of 45.6° F (8° C), an average daily maximum of 58.9° F (15° C), and an average daily minimum of 32.2° F (0° C). The average precipitation in Cheyenne is 15.06 inches (382 mm), approximately 70% of which occurs during the growing season.

Freezing temperatures may be encountered at the higher elevations every month of the year, but the lower terrain and the eastern valleys have a growing season ranging from nearly three months to a little more than five months. The average precipitation for all reporting stations is 14.31 inches (363 mm) annually.

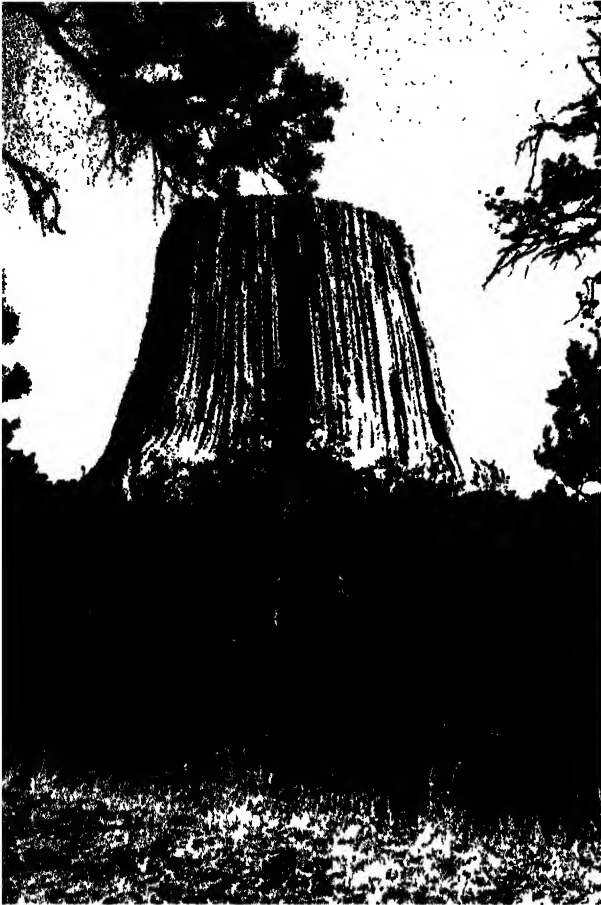
**Plant and Animal Life.** Short, tough grass covers much of the treeless eastern plains as well as many of the mountain valleys. In drier areas the grass gives way to sagebrush, greasewood, and cactus. Wyoming supports 150 varieties of grass including Buffalo grass, bluegrass, wheat grass, tufted fescues, and redtops. Mountain wild flowers include buttercup, evening star, forget-me-not, goldenrod, sour dock, and flax.

The mountains are wooded up to the timberline, and forests cover more than 10 million acres (4 million hectares), or about one sixth of the area of the state. About half of this is commercial forest, 80% of which is controlled by the federal government. The major commercial trees are Douglas fir, ponderosa pine, lodgepole pine, and spruce. Mountain mahogany is found in the foot-

The Lower Falls of the Yellowstone River in Wyoming's Yellowstone Park are almost twice the height of Niagara.

DADE THORNTON/PHOTO RESEARCHERS





GEORGIA ENGELHARD/FPB

WYOMING TRAVEL COMMISSION



Devil's Tower was named as the nation's first national monument by President Theodore Roosevelt in 1906.

hills, along with a variety of shrubs. At lower elevations, cottonwood, willow, and hawthorn trees grow. At middle elevations trembling aspen, junipers, yellow pine, saltbush, and yucca are found. Spruce, fir, and lodgepole pine grow at the higher elevations. Lichens, mosses, and other arctic plants are found growing above the timber line.

Like the plants and timber, Wyoming's animal life varies with the altitude. At lower elevations are coyotes, prairie dogs, ground squirrels, pocket gophers, and cottontail rabbits; at middle elevations, coyotes, jackrabbits, antelope, mule deer, and a few moose; and at higher elevations, snowshoe rabbits, black bear, elk, and an occasional grizzly bear or mountain lion. The sportsman can find game birds including ducks, geese, grouse, pheasants, and wild turkeys and several varieties of trout in the mountain streams. The trumpeter swan, once almost extinct, may be found in both Yellowstone and Grand Teton national parks, along with the white pelican and great blue heron. The bald eagle and the golden eagle also make their home in Wyoming. The only poisonous snake to be found in Wyoming is the prairie rattlesnake.

**Mineral Resources.** Wyoming's first productive oil wells were drilled in 1883 in the Dallas Field. All counties except Teton and Platte produce oil, and since World War II petroleum has been of tremendous economic importance. Wyoming also produces natural gas, coal, and trona (hydrated sodium bicarbonate). Major uranium deposits are located in the basins of the Powder, Shirley, and Wind rivers. There are also several deposits of iron ore in the state.

Other mineral resources include gemstones, particularly agate and jade, and stone, gypsum, bentonite, clay, pumice, vanadium, limestone, sulfur, and vermiculite.

**Conservation.** The low rainfall made many people conservation conscious early in the history of Wyoming settlement. The state delegation to Congress, beginning in 1890 with Senators Joseph M. Carey and Francis E. Warren, worked hard for the extension of federal assistance in the conservation and use of water for irrigation and power.

Yellowstone Park Timberland Reserve (now Shoshone National Forest), the nation's first timber reserve, was established in 1891. Severe droughts in the 1930's and 1950's emphasized the need for conservation of soil and water, and by 1958, two thirds of the state had been organized in 44 soil conservation districts. There were also eight Bureau of Reclamation irrigation projects (Minidoka, Eden, Riverton, Shoshone, Kendrick, North Platte, Hanover Bluff, Owl Creek, and Seedskaadee) and a number of hydroelectric power plants.

Conservation of oil and gas resources has met resistance from interests eager for quick exploitation, but since 1919 the legislature has eliminated the worst excesses, and in 1951 a state oil and gas conservation commission was established. Conservation of animal resources is supervised by the

The broad and rolling winter terrain of Union Pass in the Wind River Range is popular with snowmobilers.

## WYOMING

**COUNTIES**

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• **County seat**



# WYOMING

Shoshoni 487	D2	Atlantic (peak)	D3	Dry Fork, Powder (riv.)	F2	Jackson (lake)	B2	Porcupine (creek)	G2
Sinclair 800	E4	Bacon Ridge (mts.)	B2	Du Noir (riv.)	G2	Jackson (peak)	B2	Powder (riv.)	F2
Slater 8	H4	Badger (creek)	E2	Eagle (peak)	B1	John D. Rockefeller, Jr.,		Rattlesnake (hills)	F2
Smoot 310	B3	Badwater (creek)	E2	Eden Valley (res.)	C3	Mem. Pkwy.	B1	Rattlesnake (range)	E3
South Pass City 10	D3	Beaer (creek)	H4	Encampment (riv.)	F4	Keyhole (res.)	H1	Rawhide (creek)	H3
South Superior 586	D4	Bear (riv.)	B4	Fernis (mts.)	E3	La Barge (creek)	B3	Rawhide (creek)	G1
Spotted Horse 2	G1	Bear Lodge (mts.)	H1	Fivemile (creek)	D2	Lamar (riv.)	B1	Rocky (mts.)	C1
Story 637	F1	Bear River Divide (mts.)	B4	Flaming Gorge (res.)	C4	Lance (creek)	H2	Saint Marys (peak)	D3
Sundance 1,139	H1	Beaver (creek)	D3	Flaming Gorge Nat'l		Laramie (mts.)	G3	Salt (riv.)	B3
Sunrise 29	H3	Beaver (creek)	H2	Rec Area	C4	Laramie (peak)	G3	Salt River (range)	B3
Superior 273	D4	Belle Fourche (riv.)	H1	Fontenelle (creek)	B3	Laramie (riv.)	G4	Salt Wells (creek)	D4
Sussex 25	F2	Big Goose (creek)	E1	Fontenelle (res.)	B3	Ledy (mt.)	B2	Savory (creek)	E4
Ten Sleep 311	E1	Bighorn (basin)	D1	Fort Laramie Nat'l Hist. Site	H3	Lewis (lake)	B1	Seminole (mts.)	E3
Theyer Junction 15	D4	Bighorn (lake)	D1	Fortress (mt.)	C1	Lightning (creek)	G2	Seminole (res.)	E3
Thayne 287	D4	Bighorn (mts.)	E1	Fossil Butte Nat'l Mon.		Little Laramie (riv.)	G4	Shell (creek)	F3
Thermopolis 3,247	D2	Bighorn (riv.)	D1	Francis E. Warren		Little Medicine Bow (riv.)	F3	Shirley (basin)	F3
Tie Siding 3	G4	Bighorn Canyon Nat'l		A.F.B. 3,832	G4	Little Missouri (riv.)	H1	Shoshone (lake)	B1
Torrington 5,551	H3	Rec. Area	D1	Fremont (lake)	C3	Little Muddy (creek)	B4	Shoshone (riv.)	D1
Turnerville 85	A3	Big Sandy (res.)	C3	Fremont (peak)	C2	Little Popo Agie (riv.)	D3	Shoshone, North Fork	
Ucross 17	F1	Big Sandy (riv.)	C3	Gannett (peak)	C2	Little Powder (riv.)	G1	(riv.)	C1
Ulm 25	F1	Blair (creek)	C4	Gas (hills)	E3	Little Sandy (creek)	C3	Shoshone, South Fork	
Upton 980	H1	Blacks Fork, Green (riv.)	C4	Glendo (res.)	H3	Little Thunder (creek)	G2	(riv.)	C1
Valley 10	C1	Black Thunder (creek)	G2	Gooseberry (creek)	D1	Lodgepole (creek)	H2	Sierra Madre (mts.)	E4
Van Tassell 8	H3	Bonneville (mt.)	C3	Grand Teton (mt.)	B2	Lodgepole (creek)	H4	Slate (creek)	C3
Veteran 80	H4	Boulder (lake)	C3	Grand Teton Nat'l Park	B2	Madison (plat.)	B1	Smiths Fork (riv.)	B3
Walcott 200	F4	Boysen (res.)	D2	Granite (mts.)	E3	Medicine Bow (range)	F4	Snake (riv.)	B2
Waltman 9	E2	Buffalo Bill (dam)	C1	Great Divide (basin)	E3	Medicine Bow (riv.)	F3	South Cheyenne (riv.)	H2
Wamsutter 240	E4	Buffalo Bill (res.)	C1	Green (mt.)	E3	Middle Piney (creek)	B3	South Piney (creek)	B3
Wapiti 130	C1	Buffalo Fork, Snake (riv.)	B2	Green (riv.)	C4	Muddy (creek)	D2	Sweetwater (riv.)	D3
Wendover 17	H3	Bull Lake (res.)	C2	Green, East Fork (riv.)	C3	Muddy (creek)	F3	Sybilie (creek)	G4
Weston 10	G1	Burwell (mt.)	C2	Green River (mt.)	C2	Muddy (mt.)	F3	Table (peak)	B2
West Thumb-Grant Village 5	B1	Caballo (creek)	G1	Greybull (riv.)	D1	Muskrat (creek)	E2	Tasapot Dome (mt.)	F
Wheatlands 3,271	H3	Casper (range)	F3	Grays (riv.)	B3	Needle (mt.)	C1	Teton (range)	B2
Wilson 480	B2	Cheyenne (riv.)	H2	Gros Ventre (riv.)	B2	New Forks (lakes)	C2	Thompson (mt.)	B3
Wolf 18	E1	Chugwater (creek)	H4	Guernsey (res.)	H3	Niobrara (riv.)	J3	Tongue (riv.)	F1
Worland 5,742	E1	Clarke Fork (riv.)	C1	Hams Fork (riv.)	B4	North Laramie (riv.)	G3	Washburn (mt.)	B1
Wright 1,236	G2	Clear (creek)	F1	Hazleton (peak)	E1	North Platte (riv.)	H3	Wheatland (res.)	G4
Wyarno 101	G2	Cloud (peak)	E1	Heart (lake)	B1	Nowater (creek)	E2	Willow (creek)	F2
Yellowstone National		Continental (peak)	D3	Henrys Fork, Green (riv.)	C4	Nowood (riv.)	E1	Willow (lake)	C2
Park 350	B1	Cooper (lake)	G4	Hoback (peak)	B2	Ocean (lake)	D2	Wind (riv.)	C2
Yoder 136	H4	Cottonwood (creek)	B4	Hoback (riv.)	B2	Old Woman (creek)	H3	Wind, North Fork (riv.)	C2
OTHER FEATURES				Holmes (mt.)	B1	Owl, North Fork (creek)	D2	Wind River (canyon)	D2
Absaroka (range)	C1	Crazy Woman (creek)	F1	Horse (creek)	B3	Owl Creek (mts.)	D2	Wind River (range)	C2
Albert (creek)	B4	Crow (creek)	H4	Horseshoe (creek)	G3	Palisades (res.)	A2	Wind River Ind. Res.	C2
Alcova (res.)	F3	Deadman (mt.)	B2	Hunt (mt.)	E1	Pass (creek)	F4	Wood (riv.)	C2
Antelope (creek)	G2	Devils Tower Nat'l Mon.	H1	Index (peak)	C1	Pathfinder (res.)	F3	Wyoming (peak)	B3
Antelope (hills)	D3	Dry (creek)	C2	Inyan Kara (creek)	H1	Pilot Butte (res.)	D2	Wyoming (range)	B2
Aspen (mts.)	C4	Dry Cottonwood (creek)	D1	Inyan Kara (mt.)	H1	Poison (creek)	E2	Yellowstone (lake)	B1
		Dry Fork, Cheyenne (riv.)	G2	Isabel (mt.)	B3	Poison Spider (creek)	F3	Yellowstone (riv.)	B1
						Popo Agie (riv.)	D3	Yellowstone Nat'l Park	B1

▲ County seat.



F B GRUNZWEIG/PHOTO RESEARCHERS

Wyoming's majestic Grand Teton range forms the center of a vast protected wilderness and wildlife area.

#### LARGEST CENTERS OF POPULATION

City or metropolitan area	1990	1980	1970
Cheyenne	50,008	47,283	43,505
Metropolitan area	73,142	68,649	...
Casper	46,742	51,016	39,361
Metropolitan area	61,226	71,856	51,264
Laramie	26,687	24,410	23,143

#### RESIDENT POPULATION SINCE 1870

Year	Population	Year	Population
1870	9,118	1960	330,066
1880	20,789	1970	332,416
1900	92,531	1980	469,557
1920	194,402	1990	453,588
1940	250,742		

Gain, 1980-1990: -3.4% (U.S. gain, 9.8%). Density, 1990: 4.7 persons per sq mi of land area (U.S. density, 70.3)

#### URBAN-RURAL DISTRIBUTION

Year	Percent urban	Percent rural
1920	29.4 (U.S., 51.2)	70.6
1930	31.1 (U.S., 56.2)	68.9
1940	37.3 (U.S., 56.6)	62.7
1950	49.8 (U.S., 64.0)	50.2
1960	56.8 (U.S., 69.9)	43.2
1970	60.5 (U.S., 73.5)	39.5
1980	62.7 (U.S., 73.7)	37.3

Texas and the Midwest. The state's Native American population is about 9,500, many of them Arapahoe and Shoshone who live on the Wind River Indian Reservation.

The people of Wyoming are mainly Protestant. About 6% are Mormons, and about 18% are Roman Catholics. Protestant denominations include Methodist, Episcopalian, Presbyterian, Lutheran, Baptist, Disciples of Christ, Seventh-Day Adventist, and United Church of Christ. The Eastern Orthodox Church also is represented.

Wyoming's electoral votes have been about equally divided between Democratic and Republican presidential candidates since the early 1930's. The cities in the southern part of the state are mainly Democratic, balancing the rural areas to the north, which are largely Republican.

A rancher ropes a stray calf. Cattle are the chief source of Wyoming's agricultural income.

FRITZ HENLE/PHOTO RESEARCHERS

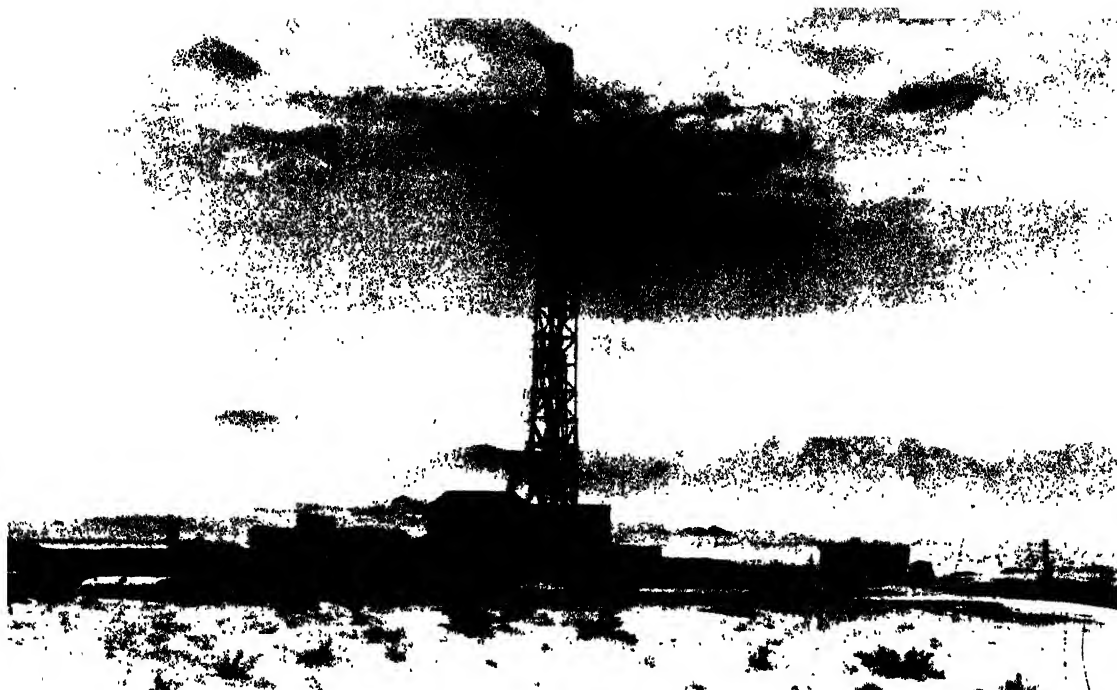
Wyoming game and fish commission. In addition, the state has four national wildlife refuges and the National Elk Refuge.

## 2. The People

In the late 19th century, Wyoming was a "Cattlemen's Commonwealth" and the dominant cattlemen resented encroachments by homesteaders on the public lands they had been using. The day of the cattleman has never really ended, although people with other economic interests have a greater voice than they once had. A cowboy astride a bucking horse adorns Wyoming license plates, and every summer dozens of rodeos throughout the state recall the cow country life of the 1880's.

**Characteristics of the Population.** Most of the approximately 454,000 residents of Wyoming are American-born, and many of them are direct descendants of the original settlers who came from





COURTESY PACIFIC GAS TRANSMISSION CO

Drilling rigs are a familiar sight in Wyoming. All but two of the state's counties are producers of petroleum.

**Main Centers of Population.** More than half of Wyoming's people live in urban areas. The state contains only a few moderate-size cities. Most of the cities are located in the southern part of the state along its major interstate highway. Cheyenne, the capital and largest city, has a population of about 50,000 and is an intercontinental missile-launching center with growing economic diversification. The second-largest city is Casper, the oil "capital" and a center for cattle, sheep, and wholesaling. Other important cities in Wyoming are Laramie, a university town; Rock Springs, a wool and coal-mining community; and Sheridan, a cattle, dude ranch, and tourist center.

### 3. The Economy

Until 1910 the economy of Wyoming was based on cattle and sheep, with some support from rail transportation and coal mining. Later these were supplemented by the extensive production of petroleum, particularly after World War II; the tourist business; some expansion of farming; and, beginning in the 1950's, uranium mining and milling. Efforts to attract large-scale industrial plants have been generally unsuccessful, and the state is the least industrialized in the Union.

**Mining.** Mining is the most important industry in Wyoming, and petroleum is its major product. There are over 10,000 producing oil wells and over 900 natural gas wells in the state.

Wyoming is the nation's leading uranium producer. Uranium was first discovered and mined in the Silver Cliff mine in Lusk in 1918. In 1953 mining operations began in the Pumpkin Buttes area of Campbell county. Important uranium mines are located in Big Horn, Carbon, Campbell, Converse, Crook, Fremont, Johnson, and Natrona counties. The main center for the milling of uranium is Riverton.

Coal production is a rapidly expanding industry. The main fields of Wyoming's vast beds of bituminous and subbituminous coal are located at

Rock Springs, Hanna, Kemmerer, Sheridan, Gillette, and Glenrock. Wyoming is also a leader in the production of bentonite and soda ash. Among its other mineral products are iron ore, sand, stone, and gravel.

**Agriculture and Ranching.** Ranching is the state's second most important industry. A large portion of the state is covered with ranches and farmlands. About 90% of the agricultural land is used for grazing, and only 6% for crops. Many of the crops raised are used to feed livestock. The principal crops are beans, sugar beets, alfalfa, wild hay, wheat, oats, barley, corn, and potatoes. Other agricultural products are poultry, dairy products, eggs, horses, and honey.

Although the number of ranches and farms in Wyoming (about 7,000) has tended to decrease, their average size (about 4,875 acres, or 1,950 hectares) has increased. Ranchers may lease federal lands for grazing, and with special permission, these lands may be fenced.

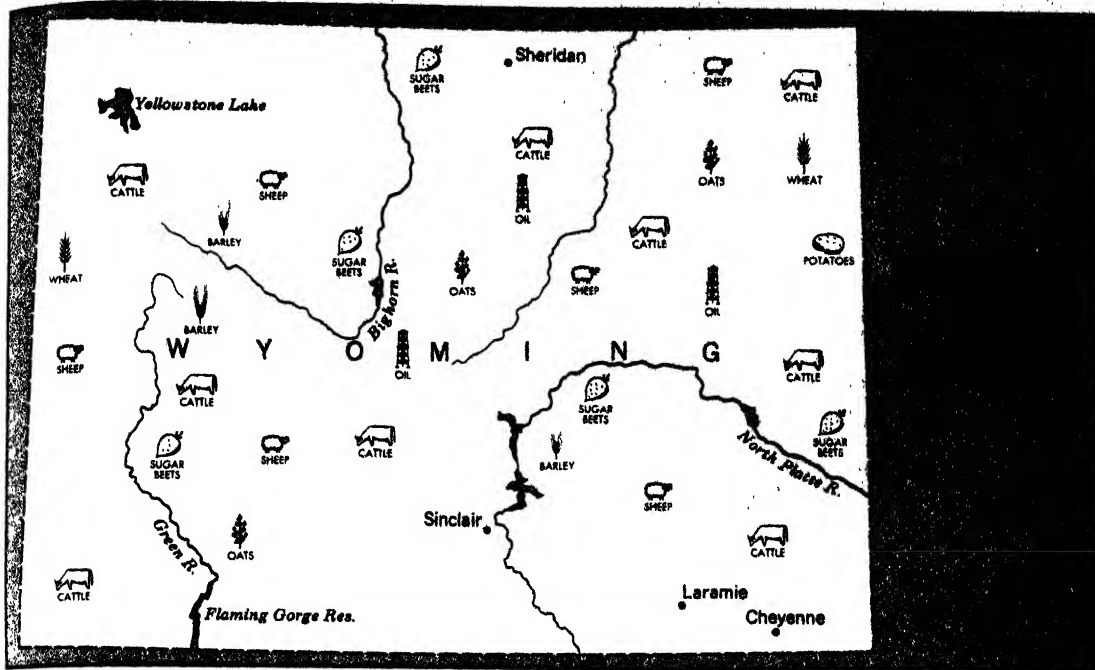
**Manufacturing.** Almost all of the manufacturing is concerned with processing petroleum and

### PERSONAL INCOME IN WYOMING

Source	1960	1970	1980
	(Millions of dollars)		
Farms .....	51	79	107
Mining .....	63	115	1,017
Construction .....	84	78	467
Manufacturing .....	48	61	197
Transportation, communications, and public utilities .....	72	105	415
Wholesale and retail trade .....	97	143	492
Finance, insurance, and real estate .....	19	32	139
Services .....	69	118	463
Other industries .....	1	4	13
Government .....	106	234	687

(Dollars)  
Per capita personal income ..... 2,248 3,686 10,898  
Per capita income, U.S. .... 2,216 3,945 9,521

Source: U.S. Department of Commerce, *Survey of Current Business*.



coal products, uranium, and other minerals mined in the state. Food processing, particularly sugar refining and the manufacture of cheese and meat products, and the manufacture of flight instruments and flight testing equipment constitute the bulk of the state's other manufacturing industries.

**Transportation.** Two east-west routes in southern Wyoming that cross the Continental Divide have been used by every means of land transportation in Wyoming's history. One of these routes became U. S. 80, a major interstate highway that crosses the nation. Stage lines operated here in the 1850's. In 1860-1861 the Pony Express provided fast communication.

Between 1867 and 1869 the main line of the Union Pacific Railroad was built across southern Wyoming. Today Wyoming has about 2,400 miles (3,862 km) of railroad track serving passengers and freight, including one of the few north-south lines in the west, and 20,000 miles (32,185 km) of maintained roads and highways.

There are about 90 airports in the state. The busiest commercial airports are those at Cheyenne and Casper.

#### 4. Government

Wyoming's constitution as approved at the time of statehood in 1890 has not been changed very much, although some parts have been modi-

Thousands of elk migrate each winter to a refuge near Jackson when their usual forage is buried by snow.

JOAN KRAMER AND ASSOCIATES/A. DEVANEY, INC., N. Y.

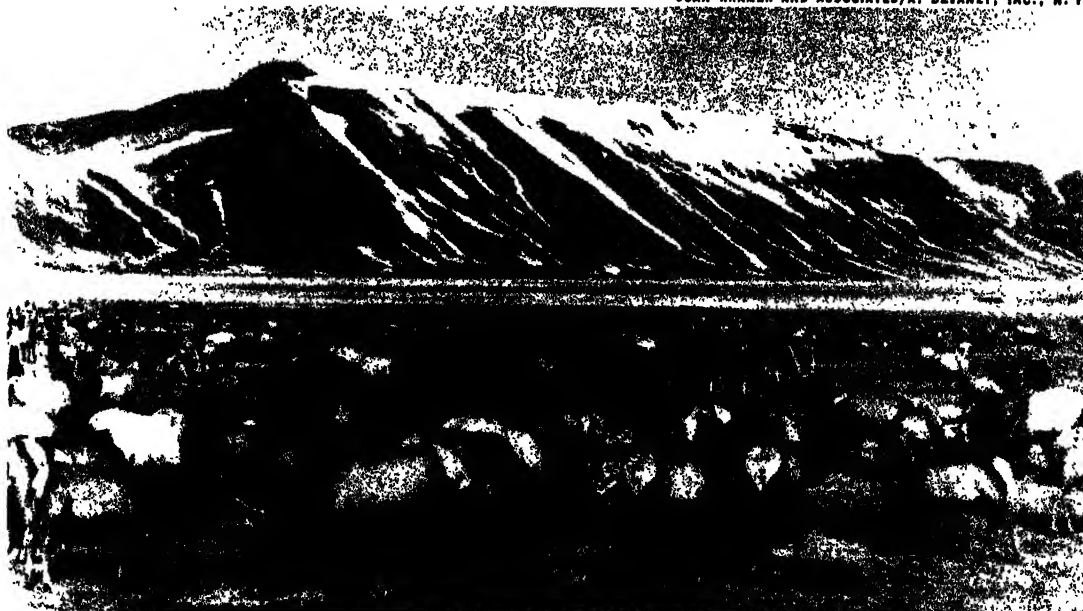




PHOTO FROM EUROPEAN/PA

The State Capitol was built at the end of the 19th century in Cheyenne, Wyoming's capital city since 18

fied by amendments. To call a new constitutional convention or to add amendments is difficult. In either case, a two-thirds vote of each branch of the legislature must be followed by the approval of a majority of the electors who cast any ballots at the next general election.

Voters in Wyoming must be citizens of the United States, at least 18 years of age, and residents of the state for one year, of the county for 60 days, and of the district for ten days. The state sends two senators and one representative to the U. S. Congress.

**Structure of Government.** The state's chief executive is the governor, who is elected to a four-year term and may serve an unlimited number of terms. There is no lieutenant governor. If a vacancy occurs, the secretary of state serves as governor until the next general election. Other elected officials in the state are the secretary of state, auditor, superintendent of public instruction, and treasurer. All are elected for four-year terms and may serve for an unlimited number of terms, except the treasurer who may not succeed himself. The governor appoints several important state officials, including the attorney general and the heads of the budget and personnel departments. He has the right to veto legislation passed by the state legislature, but his veto may be overridden by a two-thirds vote in each house of that body.

Wyoming has a bicameral legislature consisting of a Senate and a House of Representatives. The 30 senators are elected to four-year terms, and the 62 representatives are elected to two-year terms. The legislature meets annually. General sessions are opened on the second Tuesday of January in odd-numbered years. Budget sessions convene in even-numbered years beginning on the second Tuesday of January. Sessions may not last longer than 40 days in one year, or 60 in two. Special sessions may be called by the governor.

Wyoming has a state supreme court of five justices appointed by the governor for eight-year

## GOVERNORS OF WYOMING

### Territorial

John A. Campbell	1869-1875
John M. Thayer	1875-1878
John W. Hoyt	1878-1882
William Hale	1882-1885
Francis E. Warren	1885-1886
George W. Baxter	1886
Thomas Moonlight	1887-1889
Francis E. Warren	1889-1890

### State

Francis E. Warren (Rep.)	1890
Amos W. Barber (Rep., acting)	1890-1893
John E. Osborne (Dem.)	1893-1895
William A. Richards (Rep.)	1895-1899
De Forest Richards (Rep.)	1899-1903
Fenimore Chatterton (Rep., acting)	1903-1905
Bryant B. Brooks (Rep.)	1905-1911
Joseph M. Carey (Dem.)	1911-1915
John B. Kendrick (Dem.)	1915-1917
Frank L. Houx (Dem., acting)	1917-1919
Robert D. Carey (Rep.)	1919-1923
William B. Ross (Dem.)	1923-1924
Frank E. Lucas (Rep., acting)	1924-1925
Nellie Tayloe Ross (Dem.)	1925-1927
Frank C. Emerson (Rep.)	1927-1931
Alonzo M. Clark (Rep., acting)	1931-1933
Leslie A. Miller (Dem.)	1933-1939
Nels H. Smith (Rep.)	1939-1943
Lester C. Hunt (Dem.)	1943-1949
Arthur Griswold Crane (Rep., acting)	1949-1951
Frank A. Barrett (Rep.)	1951-1953
C. J. Rogers (Rep., acting)	1953-1955
Milward L. Simpson (Rep.)	1955-1959
J. J. Hickey (Dem.)	1959-1961
Jack R. Gage (Dem., acting)	1961-1963
Clifford P. Hansen (Rep.)	1963-1967
Stanley K. Hathaway (Rep.)	1967-1975
Ed Herschler (Dem.)	1975-1987
Mike Sullivan (Dem.)	1987-

## GOVERNMENT HIGHLIGHTS

**Electoral Vote**—3. **Representation in Congress**—U. S. senators, 2; U. S. representatives, 1. **State Legislature**—Senate, 30 members, 4-year terms; House of Representatives, 62 members, 2-year terms. **Governor**—4-year term; may serve consecutive terms.



terms. The justices elect one of their own members as chief justice. The court's jurisdiction is primarily appellate. There are also nine judicial districts each with either one or two judges, appointed to six-year terms. District courts have general original jurisdiction and limited appellate jurisdiction from inferior local courts, which include police courts, municipal courts, and justice-of-the-peace courts.

**Public Finance.** Wyoming has no individual or corporate income taxes. The state's principal sources of revenue are sales taxes, license fees, and property taxes, in that order. Taxes provide only slightly more than half of the state's income, the rest of its revenue being derived from federal grants and other U. S. governmental programs.

**Social Services.** The state department of public welfare administers aid to dependent children, old-age assistance, aid to the blind, aid to the totally and permanently disabled, and general assistance. The five elective officers of the state government, sitting together as the board of charities and reform, supervise the operation of the State Children's Home, for dependent children, in Casper; the Wyoming Industrial Institute, for delinquent boys, in Worland; the Wyoming Girls' School, for delinquent girls, in Sheridan; the Wyoming State Penitentiary, in Rawlins; the Wyoming State Prison Farm, in Riverton; the Wyoming State Hospital, for the mentally ill, in Evanston; the Wyoming State Training School, for the mentally deficient and epileptic, in Lander; the Wyoming Tuberculosis Sanatorium, in Basin; the Wyoming Pioneer Home, for the aged, in Thermopolis; and the Wyoming Soldiers' and Sailors' Home, in Buffalo.

## 5. Education and Culture

**Education.** The first school in what is now Wyoming was established at Fort Laramie in 1852. A school was opened in 1868 at Cheyenne where, in 1875, the first high school in the territory also was established. Meanwhile, in 1869, a territorial school law was enacted. The state board of education was not established until 1919.

**Elementary and Secondary Education.** The public elementary and secondary schools of the state are supervised by the elected state superintendent of public instruction. The nine members of the state board of education are appointed by the governor with Senate approval for six-year terms. Most of the funds for the public school system come from property taxes. Education is compulsory between the ages of 7 and 16. In addition to the public schools, there are several parochial elementary schools and parochial high schools in Cheyenne and at an Indian mission.

**Higher Education.** The University of Wyoming, a land-grant institution in Laramie, opened with a handful of students in 1887. It is the only four-year institution of higher learning in the state and includes colleges of agriculture, arts and sciences, commerce and industry, education, engineering, law, nursing, and pharmacy, and a graduate school. The state also has seven publicly supported junior colleges located in Casper, Riverton, Torrington, Powell, Sheridan, Rock Springs, and Cheyenne.

**Libraries and Museums.** The state's largest library is the William Robertson Coe Library at the University of Wyoming, whose holdings include a collection of documents on Western his-

tory. Next in size is the State Library in Cheyenne, containing a fine collection of law books. All the counties maintain libraries.

Wyoming has over 50 museums, most of which feature Indian and pioneer relics. The Whitney Gallery of Western Art at the Buffalo Bill Historical Center in Cody features a fine collection of documentary art of the Old West, with paintings and sculpture by such noted artists as Frederic Remington, Charles M. Russell, and Albert Bierstadt. The state archives are housed at the Wyoming State Museum in Cheyenne. The state also maintains historical museums in Fort Bridger and the Wyoming Pioneer Museum in Douglas. The National Park Service operates the Fur Trade Museum in Moose, natural history museums at Devils Tower National Monument, Grand Teton National Park, and Yellowstone National Park, and a historical museum at Fort Laramie National Monument. The University of Wyoming has a geological museum and a herbarium.

Other museums of interest are the Jim Catchell Memorial Museum in Buffalo, with mementoes and photographs of the Old West; the Cheyenne Frontier Days Old West Museum adjacent to Frontier Park; the Buffalo Bill Museum, the Winchester Museum, and the Plains Indian Museum in Cody; the Wyoming Pioneer's Memorial Museum in Douglas, containing extensive displays of pioneer items, Indian relics, maps, charts, newspapers, and photographs; the Grand Encampment Museum at Encampment; the Jackson Hole Historical Museum; the rock collection at the Fremont County Pioneer Museum; the Laramie Plains Museum; the Stagecoach Museum in Lusk; the Riverton Museum, which features Shoshone and Arapahoe costumes and artifacts; the Bradford Brinton Memorial Ranch in Sheridan, recreating the atmosphere of Western ranch life; and the Trail End Historical Home and Museum in Sheridan, the former home of U. S. Senator John B. Kendrick.

**Other Cultural Activities.** Art activities are sponsored by the Wyoming Arts Council, the Wyoming Artists Association, numerous county art guilds, and the art departments at the University of Wyoming and the junior colleges. Prominent nonacademic artists include Joe and Mary Back, Rupert Conrad, Nick Eggenhofer, Grant Hagen, Evelyn C. Hill, Conrad Schwiering, and Archie Teater. Robert I. Russin of the University of Wyoming has done outstanding work in sculpture. The leading art collection is in the Whitney Museum of Western Art in Cody, which includes many Frederic Remington pictures donated by the William Robertson Coe Foundation.

Prominent among the active musical organizations in the state are the Cheyenne Symphony and Choral Society, the Casper Civic Symphony, and the University of Wyoming Orchestra, String Quartet, Chorus, and Glee Club. Little-theater performances are given in the larger cities, but most of the drama activity is at the University of Wyoming.

**Communication.** The first newspaper in Wyoming, the *Daily Telegraph*, was published at Fort Bridger in 1863. Of the approximately 40 newspapers in the state, ten are dailies. The *Casper Star Tribune* and Cheyenne's *Wyoming State Tribune* and *Wyoming Eagle* have the largest circulation.

The first radio station began broadcasting at Casper in 1930. The first television station began

in Cheyenne in 1954. There are about 30 radio stations and four television stations in the state.

## 6. Recreation and Places of Interest

Two million visitors a year visit Yellowstone and Grand Teton national parks. Thousands more come for the winter sports, hunting and fishing, and dude ranches, but the state's other attractions offer a tremendous potential for tourism that has not as yet been fully explored.

**Parks and Recreation Areas.** The major tourist attractions in the state are its two national parks, Yellowstone and Grand Teton. Yellowstone, the state's largest and best-known park, was established in 1872 as the first national park in the United States. The park features the world's most celebrated geyser, Old Faithful; Mammoth Hot Springs; Yellowstone Lake; the Grand Canyon of the Yellowstone along the Yellowstone River between Canyon Village and Tower Junction; and black bears in the back country. Grand Teton is equally spectacular. Both parks offer a variety of trails for hiking and viewing the colorful scenery. There are four national forests within the state—Shoshone, Medicine Bow, Bridger-Teton, and Big Horn—and five more that extend into other states as well. Black Hills is shared with South Dakota, Caribou with Utah and Idaho, Targhee with Idaho, and Ashley and Wasatch with Utah. Recreation areas include Flaming Gorge National Recreation Area, bounded on the south by Red and Horseshoe canyons and on the north by cliffs and promontories.

The ten state parks and recreation areas include Boysen, the largest; Hot Springs, containing the world's largest hot springs; Buffalo Bill; Curt Gowdy; Glendo; Guernsey; Keyhole; Saratoga Lake; Seminoe; and Sinks Canyon. Added to these are a number of wildlife and animal preserves, the most famous of which is Jackson Hole refuge for elk.

**Historical Sites and Monuments.** A great many monuments to the Old West abound in Wyoming. These include Old Fort Caspar, a replica of the original fort at Casper; the statue of Buffalo Bill in Cody; the Devils Tower National Monument in the northwestern part of the state, the first national monument in the United States; Fort Laramie National Historic Site; Fort Bridger State Historic Site; Fossil Butte National Monument, with the world's largest deposits of fossilized fish; Cunningham Cabin in Grand Teton National Park; the Oregon Trail State Historical Site in Guernsey; and the Fetterman Massacre Monument in Sheridan.

**Trails and Float Trips.** Among the most outstanding of the many hiking trails in the state are the Amphitheater Lake Trail, Cascade Canyon Trail, Death Canyon Trail, Paintbrush Trail, Teton Crest Trail, and Valley Trail in Grand Teton National Park.

Numerous float trips are available in the most scenic parts of the state, including those on the Wyoming River, the Shoshone River at Cody; in Grand Teton National Park; and on the Snake River at Jackson. Wagon-train and prairie-schooner excursions are also available in Jackson.

**Other Places of Interest.** The state has numerous dude ranches, lodges, fishing resorts, and other tourist attractions. Among them are the Periodic Spring at Afton, which stops flowing every 18 minutes in late summer and then begins again and gradually builds to a thundering torrent; the sandstone neoclassic State Capitol and

the governor's mansion in Cheyenne; Old Trail Town, a reconstruction of the log cabin used as a hideout by Butch Cassidy and the Sundance Kid in Cody; Ayres Natural Bridge in Douglas; South Pass City, a gold-mining ghost town; and Wind River Canyon at Thermopolis.

**Annual Events.** Most of the state's major events are rodeos, the most famous of which is the nine-day Cheyenne Frontier Days held the last week of July. Other July rodeos include the Cody Stampede, Lander's Pioneer Days Rodeo and Parade, and those held at Dubois, Pinedale, Sheridan, and Rawlins. The Central Wyoming Fair and Night Rodeo in Casper, the Western Plains Fair in Cheyenne, and the Wyoming State Fair in Douglas take place in August. The Grand Teton Music Festival, held from mid-July to mid-August, features symphony concerts, a film festival, and an art exhibit. Pageants include the Green River Rendezvous in Pinedale in July and the Gift of the Waters Pageant in Thermopolis in August. From mid-June through Labor Day the Cache Creek Posse stages a mock robbery nightly in the Jackson town square. The Shoshone and Arapahoe Indians hold traditional three-day sun dances near Dubois during July. An Oktoberfest is celebrated in Worland, and horse-drawn sleigh races are held from January to April in Afton, Big Piney, Jackson, and Pinedale.

## 7. History

The early history of Wyoming reads like a classic Western novel, with a cast of Indians, trappers, cattlemen, and miners. The hero, of course, is the cowboy. The taming of Wyoming came under six different flags—of Spain, Britain, Mexico, France, the Republic of Texas, and the United States. The state's history has been shaped and affected by murder, arson, range wars, and natural disasters, but its pioneer traders and settlers proved to be as rugged and indestructible as its scenery.

**Exploration.** Before the arrival of the white man, Indian tribes roamed over the region now known as Wyoming. Among them were the Sioux, Cheyenne, Arapahoe, Crow, and Shoshone. The first white men to reach the area were probably the brothers François and Louis Joseph de la Vérendrye, who traveled southwest from the Mandan villages in 1742–1743 and may have reached the Bighorn Mountains. Toward the end of the 18th century other Frenchmen penetrated to the Wyoming country via the North Platte River.

John Colter, a veteran of the Lewis and Clark Expedition, spent the winter of 1807–1808 in northwestern Wyoming. Presumably he visited a hot-springs area just west of the present town of Cody that became the Colter's Hell of trapper stories. He also crossed through what is now Yellowstone Park, the first white man to do so. Wilson Price Hunt, an employee of John Jacob Astor, led a fur-trading expedition westward through northern Wyoming in 1811 on his way to Astoria, Oregon. The following year, Robert Stuart, another Astor employee, led a small party from Oregon through Wyoming, suffering great hardships. The party crossed the Continental Divide in the vicinity of South Pass and made its way eastward along the North Platte. In 1823–1824 a party representing the Rocky Mountain Fur Company entered Wyoming from Montana, traversed the Bighorn Basin, and crossed through South Pass. Jedediah Smith, Thomas Fitzpatrick, and James Clyman, who were in the party, often

are credited with being the first white men to go through South Pass, the gateway to the West, although the Stuart party may have done so.

In the 1820's and 1830's increasing numbers of trappers came to Wyoming for precious beaver pelts. They lived not unlike Indians, at whose hand many of them died. William Henry Ashley in 1825 organized the first trappers' rendezvous on Henry's Fork of the Green River. For the next 15 years the rendezvous was an annual affair. Trappers, white and Indian, assembled in early summer at a prearranged place to dispose of their winter's catch, to get fresh supplies, and to enjoy the conviviality they had missed during the long winter. With the decimation of the beaver, however, the rendezvous system ended in 1840.

Meanwhile, other motives than "beaver gold" began to send people along the trappers' trails. Sportsmen, scientists, and missionaries accompanied the caravans bound for the fur-trade rendezvous in the 1830's. Among these were the Methodist missionaries Jason and Daniel Lee and the botanist Thomas Nuttall, all in 1834; Samuel Parker and Marcus Whitman, in 1835; and Mrs. Whitman and Mrs. Henry H. Spalding, the first

#### FAMOUS WYOMINGITES

Arnold, Thurman Wesley (1891-1969), lawyer, trust-buster, author of *The Folklore of Capitalism* (1937).

Barrett, Frank A. (1892-1962), political leader.

Burt, Struthers (1882-1954), novelist.

Carey, Joseph M. (1845-1924), lawyer and political leader who introduced bill for Wyoming's statehood, one of the first U. S. senators from Wyoming (1890-1895), governor of Wyoming (1911-1915).

Clough, Wilson (1894- ), poet.

Crane, A. G. (1877-1955), educator.

Curry, Peggy Simpson (1911- ), writer and novelist.

Hayden, Ferdinand Vandiveer (1829-1887), geologist who surveyed the Rocky Mountains and urged that Yellowstone become a national park.

Hebard, Grace Raymond (1861-1936), historian, librarian, trustee, and professor of political economy at the University of Wyoming, leader in women's suffrage.

Hill, Evelyn Corthell (1886- ), painter.

Hopkins, Lin (1886- ), painter.

Humphrey, G. D. (1897-1973), educator.

Kendrick, John B. (1857-1933), rancher and politician, first Democratic U. S. senator from Wyoming (1917-1933).

Lockhart, Caroline (1875-1962), novelist.

Mondell, Frank W. (1860-1939), prospector, politician, U. S. representative (1895-1897, 1899-1923), House majority leader (1919-1923).

Morris, Esther Hobart (1814-1902), first woman justice of the peace in the United States.

Nye, Edgar Wilson "Bill" (1850-1896), humorist and journalist.

Olson, Ted (1899- ), poet.

O'Mahoney, Joseph Christopher (1884-1962), journalist, lawyer, politician, U. S. senator (1934-1960).

Pollock, Jackson (1912-1956), abstract expressionist painter.

Rinehart, Mary Roberts (1876-1958), novelist and mystery writer.

Ross, Nellie Tayloe (1876-1977), first woman governor in the United States (1925-1927), elected to fill unexpired term of her husband, Gov. William Bradford Ross, who died while in office, and first woman director of U. S. Mint (1933-1953).

Russin, Robert I. (1914- ), sculptor.

Schwiering, Conrad (1916- ), painter.

Simpson, Gov. Milward L. (1897- ), lawyer, political figure, governor of Wyoming (1955-1959), U. S. senator (1963-1969).

Van Devanter, Willis (1859-1941), lawyer, justice associate justice of U. S. Supreme Court (1937).

Warren, Francis E. (1844-1929), political leader.



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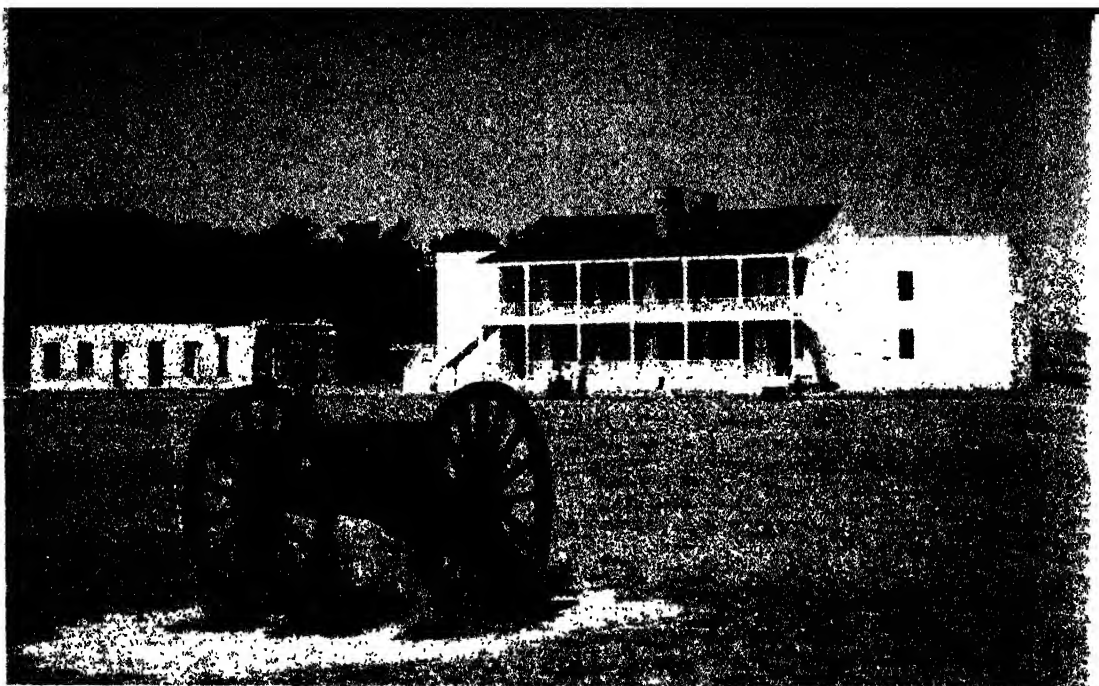
Old Faithful, erupting about every hour, is the most famous of Yellowstone's 3,000 geysers and hot springs.

white women to enter Wyoming, who came with their husbands in 1836. Father Pierre Jean De Smet, a Roman Catholic missionary, came with the supply train of 1840.

**Settlement.** In the 1840's, homeseekers in growing numbers moved through Wyoming along well-marked trails to Oregon, California, and Utah. Two small communities offered the weary travelers opportunities to secure supplies, repairs for their wagons, and replacements for their worn-out draft animals. Fort Laramie, near the junction of the Laramie and North Platte rivers in eastern Wyoming, was for many years the best-known settlement in the Rocky Mountain region. Established as a private fur-trading post in 1834, it was sold to the U. S. government in 1849 and became an Army post.

The other port of call was Fort Bridger on Blacks Fork of the Green River in southwestern Wyoming, which was opened by the famous trapper, guide, and storyteller James Bridger in 1843. Both forts were busy places in summer and very quiet in winter. In 1842 and again in 1843, Lt. John Charles Frémont of the Corps of Topographical Engineers visited Fort Laramie, and in 1845 Col. Stephen W. Kearny led five companies of the 1st Dragoons over the Oregon Trail to South Pass. See also OREGON TRAIL.

In the dozen years following 1841, more than 150,000 persons crossed South Pass westward bound. Brigham Young led the first party of Mormons through the pass in 1847, and perhaps 50,000 California-bound gold seekers passed through in 1850. The Indians understandably were alarmed at the number of whites who were using the Oregon Trail. Wild game disappeared for many miles on either side of the broad highway, misunderstandings arose, and occasionally white travelers suffered from Indian depredations.



FRED RAGSDALE/PPG

Fort Laramie's Old Bedlam, built in 1851 of lumber hauled 800 miles (1,287 km), is the oldest building in Wyoming.

To head off worse troubles, a great treaty council was held below Fort Laramie in 1851. Perhaps 10,000 Indians from several tribes were present to hear government spokesmen. In return for assurances that they would allow unmolested travel on the trails, the Indians were promised an annuity of \$50,000 in goods for 50 years.

The treaty was not a cure-all. In 1854, just below Fort Laramie, Lt. John L. Grattan, a corporal, 27 privates, and an interpreter were killed in the so-called Grattan massacre. Although the incident caused strained relations, there was little further violence until the 1860's, when an effort to open the Bozeman Trail from Fort Laramie to the Montana goldfields brought open war in northern Wyoming. The trail led through a favorite Sioux hunting ground east of the Bighorn Mountains. Near Fort Phil Kearny, Lt. Col. William J. Fetterman and 81 men were ambushed and slain on Dec. 21, 1866.

War continued until 1868, when another Fort Laramie treaty provided for the withdrawal of garrisons from the Bozeman Trail. That same year a treaty made at Fort Bridger established the Wind River Indian Reservation in central Wyoming for the peaceful Shoshone. The Arapahoe were moved to the same reservation in 1878. Meanwhile, northern Wyoming was made safe for whites when Sitting Bull's hostile Sioux fled to Canada after the Custer massacre in southern Montana in 1876.

**Statehood.** The Union Pacific Railroad entered southern Wyoming in 1867 and had crossed into Utah by 1869. Cities sprang up along its route—Cheyenne, Laramie, Rawlins, Rock Springs, Green River, Evanston—and this influx of population gave strength to a movement to organize Wyoming as a territory. From time to time the Wyoming region had been a part of various territories and was included in Dakota Territory in 1868, when Congress passed an act (July 25) creating Wyoming Territory. One of the first acts of the new territorial government

was to give women the right to vote and to hold office. The measure was signed by Gov. John A. Campbell on Dec. 10, 1869. The 1870 census showed 9,118 people in the territory. Rapid growth thereafter brought demands for statehood, which led to the admission of Wyoming to the Union on July 10, 1890. The state was given the same boundaries the territory had had.

Hundreds of thousands of Texas longhorns were trailed into Wyoming in the 1870's and

#### HISTORICAL HIGHLIGHTS

- 1807 John Colter was the first white man to see the geysers and hot springs in the Yellowstone area.
- 1833 Oil was discovered east of the Wind River Mountains.
- 1834 William Sublette and Robert Campbell established Fort William (now Fort Laramie) on the Oregon Trail.
- 1843 Fort Bridger was established by James Bridger.
- 1867 The Union Pacific Railroad entered Wyoming.
- 1868 The Territory of Wyoming was created by Congress.
- 1869 Women were granted the right to vote and hold elective office in Wyoming.
- 1872 Yellowstone became the first national park in the United States.
- 1883 Wyoming's first oil well was drilled in the Dallas Field.
- 1890 Wyoming became the 44th state of the union on July 10.
- 1892 The Johnson County War between cattlemen and homesteaders broke out after a dispute over cattle rustling.
- 1906 Devils Tower became the first national monument in the United States.
- 1910 Shoshone Dam (now Buffalo Bill dam) was completed.
- 1925 Nellie Tayloe Ross became the first woman governor in the United States.
- 1929 Grand Teton became a national park.
- 1951 Uranium was discovered in Wyoming.
- 1958 F. E. Warren Air Force Base became the first U.S. intercontinental ballistic missile base.
- 1965 Minuteman missile project was completed near Cheyenne.
- 1974 Operations began at the Jim Bridger Power plant in Rock Springs.



1880's, and the state became a "Cattlemen's Commonwealth" dominated by a few hundred members of the Wyoming Stock Growers Association. For a number of years the open-range cattle business flourished, but too many cattle were thrown on the range, and the terrible winter of 1886-1887 brought disaster. Cattlemen who were fortunate enough to avoid bankruptcy then reorganized their industry; in particular, they made provision for supplementary winter feed and water. Sheepmen took advantage of the cattlemen's difficulties, and during the years 1908 to 1910 the wool industry led all others in the state.

The cattlemen lashed out against their assorted enemies on two occasions. In 1892 some of them launched an invasion of Johnson county in search of rustlers whom they had listed for execution. The invaders succeeded in killing only two of the men on their list before a sheriff's posse surrounded them. A U. S. cavalry detachment appeared opportunely, and the invaders were taken to Cheyenne for trial. Nine months later the case against them was dismissed for lack of evidence, much to the disgust of the people of Johnson county. The second act of violence came in 1909, when a group of cattlemen attacked a sheep camp near Ten Sleep, killing two prominent sheepmen and a herder. Five of the cattlemen received penitentiary sentences for the crimes. That ended the resort to extra-legal methods of settling range disputes.

**The Modern Era.** As the 20th century advanced, Wyoming citizens conformed more closely to the ways of people farther east. Population growth paralleled that of the nation, evidence of the state's maturity. In three wars, Wyoming excelled most other states in patriotic enthusiasm and willingness to make sacrifices. In the Spanish-American War the state exceeded its quota of volunteers four and one-half times, and it was claimed that a Wyoming unit raised the first U. S. flag over Manila. In World War I the state sent 11,393 young men into uniform. In World War II approximately 30,000 of the state's young men and women were in uniform, and 1,095 of them died. During and after the war, efforts were made, with small success, to bring manufacturing industry to Wyoming as some citizens wanted the state to have a broader economic base than that provided by raw-materials production and tourists.

The threat of nuclear war affected the state directly in the late 1950's. Purchase by the federal government of uranium ore spurred prospecting until enough ore bodies had been located to give Wyoming second place among the states in production and first in known reserves. Defense preparations also led to the establishment of an intercontinental ballistic-missile-launching base at Cheyenne in 1958.

In the late 1960's and 1970's state leaders renewed their efforts to attract manufacturing plants, without which the state appeared destined to remain only sparsely settled. In 1969 the Wyoming department of economic planning and development replaced the natural resources board in an effort to attract more industry.

Environmental conservation is another major concern of the state. A new agreement with the federal government in 1979 permits the state to regulate mining and reclamation on federal lands within the state.

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**WYOMING**, a city in southwestern Michigan, in Kent county, on the Grand River, adjoining Grand Rapids. Major industries include the manufacture of refrigerators, automobile bodies, and metals. Indian Mounds Park, which contains an old Indian burial ground, is nearby on the Grand River. The first land grant in Wyoming township, signed by President Andrew Jackson, is dated Dec. 1, 1835. The township was incorporated as a home-rule city on Jan. 1, 1959. Government is by commission and city manager. Population: 63,891.

**WYOMING, University of**, a coeducational land-grant university in Laramie, Wyo. It was chartered by the territorial legislature in 1886 and opened to students the following year. The university has colleges of agriculture, arts and sciences, commerce and industry, education, engineering, law, and health sciences and a graduate school. Bachelor's, master's, and doctor's degrees are granted. In addition, the Division of Adult Education and Community Service conducts extension courses throughout the state and field summer schools.

The university campus of more than 700 acres (283 hectares) is situated near the center of Laramie in a beautiful setting between the Laramie and Medicine Bow mountains. Outstanding newer structures are the William Robertson Coe Library and Fine Arts Center.

Government of the university is vested in the Board of Trustees, whose 12 voting members are appointed by the governor of Wyoming, with the consent of the state Senate, for overlapping terms of six years. In addition, the governor, state superintendent of public instruction, president of the university, and student body president are ex officio members of the board. Full-time enrollment is about 7,500.

**WYOMING VALLEY**, a valley in northeastern Pennsylvania, in Luzerne county, along the Susquehanna River. Shaped like a crescent, about 20 miles (33 km) long and 3 to 4 miles (5-7 km) wide, the valley is a fertile alluvial plain, with rich anthracite coal deposits, and is noted for its beauty. The chief city in the area is Wilkes-Barre.

The Wyoming Valley was first settled permanently by emigrants from Connecticut, organized in the Susquehanna Company, beginning in 1769. For the next 30 years it was the object of a bitter dispute between Connecticut and Pennsylvania (see PENNAMITE WARS).

During the American Revolution the valley was the scene of the Wyoming Massacre (July 3, 1778), when Butler's Rangers (see BUTLER,



JOHN) and a force of British and Indians descended on the valley. Most of the able-bodied men among the settlers had joined the Continental Army. The 300 men who remained, mostly old men and boys, gathered at Forty Fort, near Wilkes-Barre, for the defense. Outnumbered by 1,100 enemies, including 700 Indians, about two thirds of the defenders were slain in battle, and many of the survivors who surrendered were tortured and killed by the Indians.

**WYSPIAŃSKI**, vis-pyän'yä-skē, Stanisław (1869–1907), Polish dramatist and artist. He was born in Kraków on Jan. 16, 1869, and studied literature and fine arts. Regarded as the most creative Polish dramatist of the late 19th and early 20th century, he devoted a number of his plays to Polish national history, including *Legenda I* (1897), its sequel *Legenda II* (1904), *Bolesław Smiaty* (1903), and *Skalka* (1905–1907), all set in the Middle Ages; the unfinished *Zygmunt August* (1907), inspired by the Polish Renaissance; and *Legion* (1900), on the legion formed in Italy in 1848 by the Polish romantic poet Adam Mickiewicz. The best of Wyspiański's historical dramas, *Warszawianka* (1898) and *Noc listopadowa* (1904), treat the events of the ill-fated Polish uprising of November 1830.

Wyspiański also wrote a cycle of plays based on classical Greek antiquity: *Meleager* (1897; Eng. tr., 1933), *Protesilas i Laodamia* (1899; Eng. tr., 1933), *Achilleis* (1903), and *Powrót Odysa* (1907). In *Klątwa* (1899; *The Curse*), *Sędziowie* (1900; *The Judges*), and *Wesele* (1901; *The Wedding*), he dealt with various aspects of contemporary Polish life. The most interesting of these plays is *Wesele*, inspired by the marriage of the poet Lucjan Ryden to a peasant girl from the village of Bronowice near Kraków. For the structure of the drama, Wyspiański utilized techniques borrowed from the ancient Kraków Nativity puppet play, known in Polish as *szopka*. *Wesele* was an outstanding success and is a classic of the Polish theater.

As an artist, Wyspiański was noted for his designs for stained-glass windows. In 1905 he joined the faculty of the fine arts academy in Kraków. He died in Kraków on Nov. 28, 1907.

HAROLD B. SEGEL\*, *Columbia University*

**WYSS**, vēs, Johann Rudolf (1782–1830), Swiss author. He was born in Bern on March 4, 1782. Educated at various German universities, he was named professor of philosophy at the Bern Academy in 1805.

Wyss is best known for the story *Der schweizerische Robinson* (4 vols., 1812–1827), translated into English as *The Swiss Family Robinson*. This account of the adventures of a family wrecked on a desert island, patterned after Daniel Defoe's *Robinson Crusoe*, was mainly written by Wyss' father, a clergyman, for the amusement of his family. The younger Wyss completed and edited the novel, which has been a favorite story for children since it was first published. See SWISS FAMILY ROBINSON.

In 1811, Johann Rudolf Wyss wrote the Swiss patriotic song *Rufst du, mein Vaterland?* (*Callst Thou, My Fatherland?*) to the music of *God Save the King*. He also collected and edited material from Swiss history and lore, published in several books and in the literary magazine *Die Alpenrosen*, which he edited from 1811. Wyss died in Bern on March 21, 1830.

**WYTHE**, with, George (1726–1806), American patriot, judge, and legal educator, who was a signer of the Declaration of Independence. He was born in Elizabeth City county (now part of the city of Hampton), Va., the son of a landed family with Quaker antecedents. He received a rudimentary classical education from his mother and briefly attended grammar school. Because the family estate had been inherited by his elder brother at their father's death in 1729, Wythe read to be a lawyer and was admitted to the bar in 1746. He traveled on the circuit, but after the death of his wife, the former Ann Lewis, in 1748, he moved to the Virginia capital of Williamsburg. After serving as a legislative clerk he was attorney general and a member of the House of Burgesses.

In 1755, Wythe married Elizabeth Taliaferro and in that year inherited the family estate from his brother. By 1760 he had established a flourishing law practice and was attracting students to his office, including Thomas Jefferson, whose views he influenced deeply.

In 1764, Wythe vigorously challenged the proposed Stamp Act and wrote the legislature's resolution protesting its unconstitutionality. In 1765, however, with Richard Bland and several other anti-Stamp Act burgesses, he opposed Patrick Henry's Stamp Act resolutions as illogical and inopportune, since the king and Parliament still had the previous resolution under consideration. An advocate of autonomy for the colonies within the British Empire, and then of independence, he was a delegate to the Second Continental Congress and a signer of the Declaration of Independence.

Returning to Virginia in 1776, Wythe entered upon a distinguished career as a judge and legal educator. He was appointed with Thomas Jefferson, George Mason, and Edmund Pendleton to revise and draw up a law code for the state. In 1778 he was elected one of the three justices of the new High Court of Chancery, and after a court reorganization in 1789 he was the sole justice of the High Court until 1801. A stern, fair, and impartial judge, he was characterized by his contemporaries as methodical, logical, and sound, but not brilliant, in thought. His decision in *Commonwealth v. Caton* (1782) was an early and significant defense of judicial review. He published many of his more important opinions in *Decisions of Cases in Virginia by the High Court of Chancery* (1795). A republican nationalist of the school of James Madison and Jefferson, he was a brief participant in the Constitutional Convention of 1787.

Wythe was equally important as a law teacher. Recognizing the need for the formal training of lawyers, Jefferson and others established at the College of William and Mary the first professorship of law in the United States with Wythe as the professor. During his tenure at the college, from 1779 to 1790, he taught and trained John Marshall, James Monroe, Henry Clay, and other leading Virginia lawyers and jurists. His methods permanently influenced American legal education.

Wythe was poisoned by an inheritance-seeking grandnephew and died in Richmond on June 8, 1806, but not before disinheriting the youth, who was acquitted because the chief witness was a black cook whose testimony was inadmissible at that time.

D. ALAN WILLIAMS, *University of Virginia*

X					CLASSICAL GREEK		EARLY LATIN	CLASSICAL LATIN
					X		X	X
	CURSIVE MAJUSCULE (ROMAN)	CURSIVE MINUSCULE (ROMAN)	ANGLO-IRISH MAJUSCULE	CAROLINE MINUSCULE	VENETIAN MINUSCULE (ITALIC)	N. ITALIAN MINUSCULE (ROMAN)		
	X	X	X	X	X	X		

A. C. SYLVESTER, CAMBRIDGE, ENGLAND

The development of the letter X is illustrated in the chart above, beginning with the early North Semitic letter. The evolution of the majuscule (capital) is shown at top; that of the minuscule (lowercase) at bottom.

χ, ξks, the 24th letter of the English alphabet, corresponding to the 21st of the Latin, from which its position and shape are derived (the increase in number being due merely to the differentiation of *i* and *j*, and of *u*, *v*, and *w* in the English alphabet). Its name *ix* or *ex* is also of Latin origin. The combination of consonants written *x*, namely *ks*, does not exist initially in English; those words which show it are all foreign and, with hardly an exception, Greek (for example, *xylophone*). *Xavier* is a Spanish local name, and *exes* simply the Greek rendering of the Persian word *hšayathiya* (king). The Romans could not pronounce the Greek name (*xei*) of the letter, but substituted *ix* for it, not so much by inverting the order of the sounds in the name as by prefixing a vowel and then dropping the final vowel. The symbol appears in the Etruscan alphabet also, but only in *abecedaria* (which nevertheless have *ξ*, *samekh*, in addition). Etruscan inscriptions also have X with the numerical value of 10, and it is possible that this use in Latin was taken over from the Etruscans, the upper part (V) indicating one half the amount—perhaps suggested by a rude sketch of the hand with fingers and thumb outstretched. On the other hand, the V symbol (5) may have been the older, and the use of X for 10 may have been inspired by the apparently doubled V.

In modern times in algebra *x* is used to designate an unknown quantity, and hence also in the sciences (as in *X-rays*), though the concept is far from modern. As an abbreviation X is used sometimes in the sense of "extra"; for example, it is used for the additional (or extra) decretals of Gregory IX. It is also used for the older Christus-symbol (✠) as an abbreviation of *Christ*—in *Xmas*, and in Greek inscriptions for *χilio-*, "thousand(s)."

The use of X with the phonetic value *ks* is proper to the western subdivision of the ancient Greek alphabet that came to be adopted in Italy. Hence its appearance in modern western European alphabets with the same value, whereas in the Attic (eastern) Greek alphabet X (χ) has the value of an aspirated *k* (*kh* or *ch*), for which the western had Ψ. In Attic *x* is written ξ (ξ), and this is represented by the variant ξ of the Chalcidian *abecedaria*, which is also the Palestinian ξ, the Moabite ξ, Cretan and Phoenician ξ, square Hebrew ξ. Its name is *sāmekh*, "fish," and in the proto-Sinaitic texts a drawing of a fish has been identified with the Canaanitish ξ. Another view interprets *sāmekh* as "prop" (?), which is

closer to the hieroglyphic ⲭ (subsequently ⲭ). In any event, the Semitic value is *s*, and in early Greek inscriptions not only does ξ appear beside Ι (ς) for *sd* (or *zd*), just as in early Latin *z* means *s* or *ss*, but also *xs* and *xs* appear for *x*, a fact which shows that *sāmekh* was felt to be inadequate. A few early Ionic inscriptions have a symbol ξ or ξ (*h*) used in combination with *s* to signify *x*. If this had been confused with *sāmekh*, it is easy to see how the latter, used alone, might come to have the value *x*. However, evidence is lacking to prove this intermediate stage, and X (in some Greek alphabets +) has been held to be derived from ξ; in the Messapic alphabet X or + actually has the value *s*, not *x*. It is, nevertheless, noteworthy (1) that the combination *-ks-* often becomes *-khs-* and *-hs-* (Gothic *wahsjan* has *-hs-* from an older *-ks-*; compare *ahsa* beside Latin *axis*), and this becomes *ch* or *h* (Welsh *achel*, "axis"; *chwech*, "six"); (2) that another development of the same combination is *-ss-* or *s*, as in Irish *dess* beside Latin *dexter*, "right-handed"; *mos* beside Latin *mox*, "soon," like Vulgar Latin *dester* (Italian *destro*, French *destrier*), and Provençal *cis(s)ir* from Latin *exire*. In the later Greek numerical use of alphabetic symbols ξ' means "sixty," and this appears also in the Cyrillic Old Church Slavonic. The Greek name *xei* was modeled on *pei* (π), taken from the Semitic *pē*. In Old English runes Ψ, later ψ, appears instead of the older Latin *x*; its name was *colhs*, but the meaning, "elk" (?), and derivation (perhaps from Ψ, *z*) are dubious.

Nearly all modern English words containing the prefix *ex-* were borrowed from French, and show a curious variation of pronunciation; thus *x* is *gz* before accented vowels (as in *examine*, *exert*), but *ks* after accented vowels (as *execute*, *exit*). In Latin *x* was always *ks*, but this became *gz* in early French, and the French pronunciation was borrowed into English. Subsequently the influence of the normal English pronunciation of *ex-* in Latin words influenced that of most words in which the accent was thrown back onto the first syllable, though the old pronunciation still survives beside the new in a few words (*exile*, *exigence*), and some have both pronunciations even before accented vowels (*exhale*, *exhilarate*, *exude*). In Old English, especially in late West Saxon, metathesis of *xs* to *cs*, written *x*, is not uncommon (for example, *axe*, "ashes," *axian*, "ask"). The final combination *-ks* is stable (*veax*, *wax*, *axe*).

JOSHUA WHATMOUGH.



not by his horses' fault, but by fate (Homer, *Iliad*, book 19, vss. 400-410).

P. R. COLEMAN-NORTON

**XAVIER, SAINT Francis.** See FRANCIS XAVIER, SAINT.

**XAVIER UNIVERSITY**, ză'vī-ər, a Roman Catholic institution of higher education, located in Cincinnati, Ohio. It is the oldest Catholic institution of higher learning in the area once designated as the Northwest Territory. It was founded in 1831 as the Athenaeum, and nine years later passed under the control of the Society of Jesus (Jesuits). The university has five units: College of Arts and Sciences (founded 1831) and the College of Business Administration (1961), both for men; Evening College (1911), coeducational; Milford College (1925; for students in training to become Jesuits); and the Graduate School (1948), coeducational. All units except the Milford College (at Milford, Ohio) are located on the 65-acre campus in the geographical center of greater Cincinnati. The style of architecture of Xavier's modern buildings is typically Tudor. Enrollment is in excess of 6,000 students. School colors are blue and white; the rally song is *Xavier for Aye*; the athletic teams are known as "The Musketeers."

EDWARD P. VONDERHAAR.

**XAVIER UNIVERSITY OF LOUISIANA**, a co-educational Roman Catholic institution located in New Orleans, La., and founded in 1925 by the Sisters of the Blessed Sacrament for Indians and colored people. It is composed of the College of Arts and Sciences, the College of Pharmacy, and the Graduate School. Originally situated near the Garden District of New Orleans, the university moved in 1932 to its present site at Palmetto and Pine streets. The campus, covering 10 square blocks, includes the administration and main classroom building and the convent—both of which are constructed in the Gothic style and in Indiana limestone—library, men's dormitory, women's dormitories, gymnasium, science building, music building, and a \$500,000 glass-and-concrete Student Center. The university's average enrollment is approximately 1,350 students. The school colors are gold and white, and the school song is *In the Mississippi Valley*.

SISTER MARY JOSEPHINA, S.B.S.,  
President.

**X CHROMOSOME.** See CHROMOSOME.

**XEBEC**, zē'bēk, a small three-masted vessel, employed in the Mediterranean, distinguished from other European vessels by the great projection of the prow and stern beyond the cutwater and stempost. In this respect it resembles the felucca, from which it differs in having the foremast square-rigged.

**XENIA**, zēn'yə, city, Ohio, seat of Greene County, 15 miles east of Dayton, near the Little Miami River. It is a trading center for one of the state's principal agricultural areas, producing hogs, dairy cattle, feeder cattle, sheep, and such crops as fruits, grains, feed, and some tobacco. Industry within the city is varied; important manufactures include rope and twine, furniture, monuments, metal castings, synthetic rubber goods, plastics, electrical equipment, paints, and foodstuffs. There

is an airport for chartered planes. Wilberforce University is located nearby. Xenia (from the Greek word for hospitality) was founded in 1803, the year Ohio achieved statehood; it was incorporated in 1817 and became a city in 1834. The community soon attracted many pioneer industries, such as flour mills and sawmills, and experienced further economic development with the coming of the railroad in 1843. In 1918 the city of Xenia became one of the first cities to adopt the commission-manager form of government. Population: 24,664.

**XENIA AND METAXENIA**, zē'nī-ə, mēt'ə-zē-nī-ə. The term "xenia" was proposed by Wilhelm O. Focke in 1881 for the direct effect of foreign pollen on any part of a plant. Those examples best known are the changes produced in the size, shape, and color of seeds, such as the mixture of blue and yellow kernels of corn on the same cob when a yellow variety is pollinated by a blue variety. Such changes involve chiefly the endosperm. The occurrence of xenia in seeds was explained in 1898 by Sergei Nawashin when he discovered that pollen may have an effect on the genetic composition of both embryo and endosperm.

Early reports on the direct effect of pollen on tissue other than embryo and endosperm as indicated by size, shape, and color of fruit were not convincing because of inadequate or contradictory data; confusion among different factors involved, such as the presence, absence, number, or imperfect development of seeds; and physiological influences, such as number of leaves per fruit. As a consequence, xenia became restricted to most usage to the direct effect of pollen on the embryo and endosperm. A series of experiments with dates begun in 1925 produced spectacular evidence that pollen may affect not only the size, shape, and color of the seed, but also the size and the time of ripening of the fruit. "To designate the action of the male parent on tissues of the mother plant outside the embryo and endosperm," Walter T. Swingle coined the word "metaxenia." It was Swingle who suggested the theory that the embryo or the endosperm, or possibly both, secrete hormones that influence the development of the ovarian tissues of the mother plant.

Metaxenia has since been shown to occur in a number of plants, including apples (size, shape, and color) and cotton (boll maturity, length of lint). Failure to demonstrate metaxenia often may be due not only to difficulties in obtaining evidence but even more to the lack of sufficient genetic diversity among the pollen parents compared.

ROY W. NIXON

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United States Department of Agriculture

**XENOCLES**, zī-nōk'lēz, name of two ancient Athenian tragic poets.

**XENOCLES THE ELDER** (fl. 415 B.C.) defeated Euripides in a dramatic festival with his tetralogy of *Oedipus*, *Lycaon*, *Bacchae*, and *Athamas*, of which nothing remains. Ancient authors considered his poetry rather poor and condemned the construction of his plots, wherein complicated devices and sudden surprises produced the result which the natural development of the drama should have effected.

**XENOCLES THE YOUNGER** (fl. 4th century B.C.)

was mentioned in antiquity only to distinguish him from Xenocles the Elder, his grandfather. Unfortunately, not even the title of any of his tragedies survives.

P. R. COLEMAN-NORTON  
*Formerly, Princeton University*

**XENOCRATES**, zī-nōk'ra-tēz, Greek philosopher: b. Chalcodon, Bithynia, Asia Minor, 396 B.C.; d. Athens, Greece, 314 B.C. About the year 380 he migrated to Athens, where he studied philosophy under Plato and eventually presided over Plato's Academy from 339 until his death. In logic he tried to exhibit mathematics as mediating between knowledge and perception. He failed to grasp the idealism underlying Plato's ontology and, infected with Pythagoreanism, took arithmetical unity and plurality for his principles in physics and then identified ideal numbers with arithmetical numbers. The titles of over 75 treatises written by him clearly indicate that he accorded especial attention to ethics. In this philosophical area Xenocrates was most concerned that Plato's teachings should be given a more direct applicability to life.

His contemporaries respected Xenocrates for his integrity, dignity, and courtesy. Modern scholars regard him as the most faithful of Plato's followers, as the typical representative of the Old Academy, and as a brilliant teacher rather than an original thinker.

P. R. COLEMAN-NORTON  
*Formerly, Princeton University*

**XENON**, zē'nōn (symbol Xe), chemical element number 54, and the fifth member of the family of inert gases. Xenon is a colorless, odorless, and tasteless gas under ordinary conditions, and constitutes 0.086 parts per million by volume of dry air. Traces are also found in certain minerals. The density of the gas under standard conditions is 5.8992 grams per liter. Xenon, made up of 9 stable isotopes ranging in mass number from 124 through 136, has an atomic weight of 131.30. The element was discovered in England in 1898 jointly by Sir William Ramsey and Morris W. Travers, who isolated it by fractional distillation from a sample of krypton, and identified it as a new element by observing hitherto unknown lines in its emission spectrum.

Xenon has a number of commercial and scientific applications, among which may be mentioned its use in flash lamps for high speed photography, and its use in liquefied form in the particle detectors called bubble chambers, in which certain types of nuclear experiments are best performed with use of an extremely dense liquid. Xenon is obtained commercially by liquefaction and distillation of air, followed by special purification processes.

See also GAS—*Separation of Gases*.

KENNETH W. PERKINS

**XENOPHANES**, zī-nōf'a-nēz, Greek philosopher and poet: b. Colophon, Ionia, Asia Minor, c. 590 B.C.; d. probably in Sicily, c. 478 B.C. An exile or a fugitive from Colophon when 25 years old, he lived mostly in southern Italy and Sicily. Xenophanes' philosophy, such as it is, was embodied in his poems, principally elegies and satires on various subjects, recited at festivals. Some 40 fragments remain.

Xenophanes ridiculed the popular religious notions of the Greeks, who believed in a plurality

of deities in human form and accepted the traditional tales of the divinities' vices. He held that that which is divine can only be one, that there can be only one best, and, therefore, that God must be conceived as one. Xenophanes was more of a pantheist than a monotheist, for he identified God with the world and considered God as a sentient being, though without organs of sense, unchangeable, undivided, unmoved, undisturbed, passionless, and governing the world through thought. Among the testimonies to Xenophanes' philosophy his attack on the Pythagorean doctrine of transmigration of souls is perhaps the most prominent.

Although ancient authors considered Xenophanes the founder of the Eleatic school of philosophy, most modern scholars suggest that he was rather its forerunner, whose seeds of thought were transformed into philosophical principles by Parmenides, the real creator of the sect. It was with Xenophanes, who was primarily a critical thinker rather than a creative philosopher, that the Western quarrel between philosophy and religion originated.

See also ELEATIC SCHOOL; PARMENIDES.

P. R. COLEMAN-NORTON  
*Formerly, Princeton University*

**XENOPHON**, zēn'ə-fūn, Greek historian, essayist, and soldier: b. Athens, Greece, c. 430 B.C.; d. Corinth, c. 354 B.C. During the latter part of the Peloponnesian War (431–404 B.C.), he both served in the Athenian cavalry and studied philosophy under Socrates. At the war's end Xenophon probably was disheartened by the destruction of the Delian League (q.v.), controlled by Athens, and perhaps was disgusted with the deterioration of Athenian democracy. However this may have been, in 401 he accepted an invitation to join, as an officer of Greek mercenaries, the army of Cyrus the Younger, who desired to dethrone his older brother Artaxerxes II Mnemon, king of Persia. Xenophon accompanied the expedition from Sardis in Asia Minor, fought at Cunaxa (near Babylon) in Persia, where Cyrus was killed and his cause collapsed, and then played a prominent part in conducting the retreat of over 12,000 Greek survivors from Cunaxa to Chrysopolis on the Sea of Marmara, which less than 6,000 Greeks reached in 399 after marching almost 1,300 miles, mostly through mountainous terrain inhabited by hostile tribes. Most modern military historians consider Xenophon, who in this perilous operation evinced consummate qualities of leadership and employed supreme tactical ability, as the inventor of retreat tactics still valid in warfare amid mountains.

After he had heard, while still in Asia, that Athens had banished him (probably because of his Spartan sympathy and his Persian friendship—both Sparta occasionally and Persia traditionally being hostile to Athens), Xenophon served with the Spartan expeditionary forces warring against Persian satraps in Asia Minor (399–394) and then returned to Greece. There he perhaps participated in the Spartan victory over Thebans and Athenians at Coronea in Boeotia (394). King Agesilaus II of Sparta then presented Xenophon with an estate at Scillus (near Olympia) in Elis, where he devoted himself to farming, hunting, entertaining, and writing. The Elean recovery of Scillus from Sparta (c. 371) induced Xenophon to move to Corinth. Although Athens restored Xenophon's citizenship (c. 369), it is uncertain whether



later he visited Athens, but it is known that he sent his two sons thither to serve in the Athenian cavalry.

**His Writings.**—Xenophon wrote probably most of his known 14 works during his two decades at Scillus. The most famous is *Kyrou anabasis* (Lat. *Cyri anabasis*; Eng. *Cyrus' Anabasis* or, more simply, *Anabasis*, q.v.), in seven books, which vividly describes Cyrus' campaign and the Greeks' retreat from Cunaxa through Persia and Asia Minor. *Hellenika* (Lat. *Hellenica*; Eng. *Greek Affairs*), in seven books, relates the contemporary history of Greece (411–362 B.C.) and displays pro-Spartan partiality. His most finished treatise is *Kyrou paideia* (Lat. *Cyropaedia*; Eng. *Cyrus' Education*), in eight books, which is an idealized biography of Cyrus the Elder (Cyrus the Great; r. 550–529 B.C.), the founder of the Persian monarchy. It has little value as authentic history and it contains numerous romantic touches, but it offers many practical suggestions for educating youths and it presents Xenophon's model of a wise and beneficent ruler.



The Bettmann Archive

Xenophon

*Lakedaimonion politeia* (*Polity of the Lacedaemonians*) lauds Spartan institutions. *Agessilaos*, a panegyric of King Agesilaus II of Sparta, is among the earliest Greek biographies. *Hipparchikos* (Lat. *Hipparchicus*; Eng. *Cavalry Commander*) describes the duties of a commander of cavalry and presents methods for improving the contemporary use of cavalry. *Peri hippikes* (*On Horsemanship*) supplements *Hipparchikos* and is the oldest complete manual on this subject still extant. *Kynegetikos* (Lat. *Cynegeticus*; Eng. *Fond of Hunting*) praises hunting, discusses the breeding and the training of dogs, particularly of hunting dogs, and suggests various ways of capturing game. *Hieron* is a fictitious conversation

between Hiero I, tyrant (king) of Syracuse in Sicily, and the poet Simonides of Ceos, who sojourned at Syracuse in 476 B.C. The dialogue discusses the comparative happiness of a despot and a private citizen and how an autocrat can secure his subjects' affection.

*Symposion* (Lat. *Symposium*; Eng. *Banquet*) depicts an amusing and imaginary wine party, whereat Socrates and some of his followers discourse on love and friendship. *Oikonomikos* (Lat. *Oeconomicus*; Eng. *House Manager*) is a contrived discussion between Socrates and his disciple Critobulus on management of a rural estate. It lauds agriculture; describes the duties of the householder, his wife, and their servants; contains practical advice for arranging rooms and their contents; and presents Xenophon's ideas about the good life in the country. *Poroi e peri prosodon* (*Ways and Means or On Revenues*) suggests methods for improvement of Athenian public finance, such as increasing the number of resident aliens engaged in commerce and managing efficiently the state-operated silver mines. *Apologia Socratous* (*Socrates' Apology*) shows why Socrates failed to make a better defense of himself at his trial in 399 B.C.

*Apomnemonemata Socratous* (Lat. *Socratis memorabilia*; Eng. *Memorable Facts About Socrates*), in four books, is an interpretation of the philosopher's life and teaching. It defends Socrates and presents many convincing reminiscences of and anecdotes about his teacher. Much scholarly debate still surrounds Xenophon's trustworthiness compared to Plato's in respect to the real Socrates. Certainly Xenophon is seen to be inferior to Plato in comprehending the difficult points of Socrates' doctrines. But Xenophon surpasses Plato in presenting a portrait of Socrates the teacher as opposed to Socrates the thinker. It is an entirely practical work, such as Xenophon was qualified to compose. That Xenophon wrote *Athenaion politeta* (*Polity of the Athenians*), an oligarch's disparaging discussion of the Athenian democracy, was doubted even in antiquity, and by modern scholars has been adjudged to be the work of an unknown author.

Xenophon, whom later Greeks called the "Attic Bee" because of his literary industry, writes mostly in clear and simple, yet sometimes elegant and rhetorical, language. His chief faults are tedious repetition of trite thoughts, persistent moralizing and insistent didacticism, obvious borrowing from earlier authors, and insufficient understanding of economics, history, and philosophy. But these failings perhaps are outweighed by his strong humanity, simple piety, admirable versatility in literary genres, extraordinary insight into military tactics, and sympathetic interests.

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**XENOPHON OF EPHEBUS.** See **EPHESIACA**.

**XENOTIME**, zên'a-tīm (formula YPO<sub>4</sub>), a mineral crystallizing in the tetragonal system in short prismatic crystals. The hardness is 4–5, and the

specific gravity 4.4–5.1. The luster varies from vitreous to resinous, and it is transparent to opaque. It resembles zircon ( $\text{ZrSiO}_4$ ) in color and crystal form, and has a similar crystal structure, but is distinguished from zircon by a lower hardness and a good prismatic cleavage.

Xenotime occurs as an accessory mineral in granites and syenites, and crystals may occur in granite pegmatites. It is usually found in detrital deposits, and is mined in placer deposits in North Carolina, Georgia, Alabama, Brazil, Madagascar, and New Zealand. It occurs also in pegmatites in Norway, Sweden, and Japan. Xenotime is a commercial source of yttrium and other rare earth elements, and in placer deposits may be associated with more valuable thorium minerals.

LEWIS S. RAMSDELL.

### XERARCH SUCCESSION, zē'rärk sək-sēsh'ən.

Plants and associated animals invariably invade unoccupied habitats where their establishment produces environmental changes that permit still other organisms to come in, superseding each other in a predictable pattern over a period of time. The sequence of interrelated environmental and biotic changes, known as succession, varies in direction and rate largely in response to moisture conditions. Succession initiated in dry habitats is distinguished as "xerarch" (Gr. *xeros*, dry, and *arche*, beginning), and that on wet sites as "hydrarch."

An extreme xerarch succession occurs on bare rock. Certain mosses and lichens are able to attach themselves and survive repeated desiccation between periods of precipitation. The tiny patches which slowly emerge catch dust and plant remains upon which other mosses and coarse lichens can grow. Now a mat begins to form which may become thick enough to support herbaceous seed plants and, later, drought-resistant shrubs or even, ultimately, trees. As the mat thickens and succession progresses at the center, the pioneers will have migrated outward around the periphery, and the sequence of growth forms which followed the pioneers will show in narrow, irregular zones from the margin inward. The slow process is always subject to interruption by disturbance, and it progresses only as moisture conditions improve with thickening and expansion of the mat.

See also COMMUNITY.

HENRY J. OOSTING.

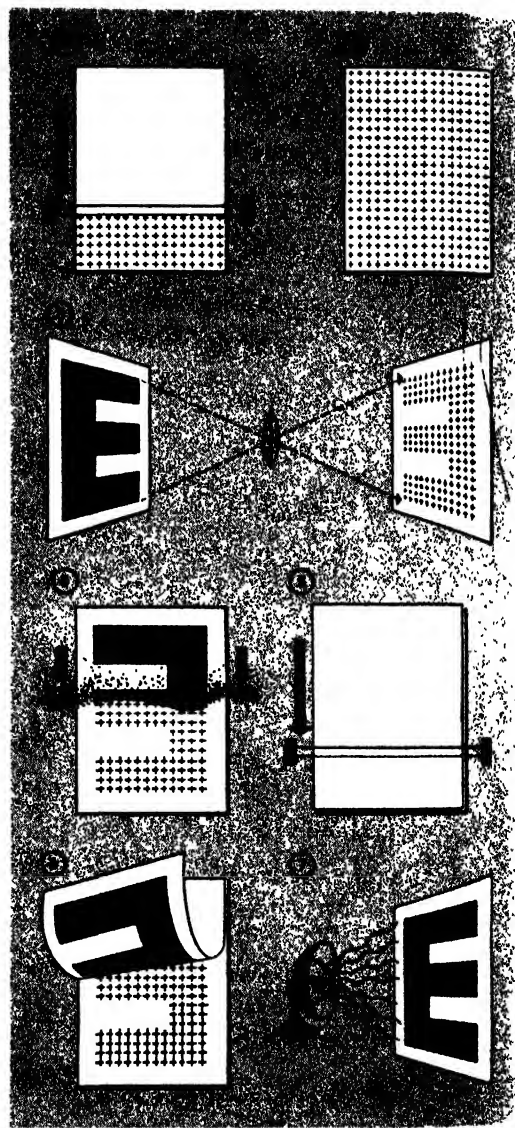
### XERES DE LA FRONTERA. See JEREZ.

**XEROGRAPHY**, zī-rōg' rə-fē, an electrostatic reproduction process, invented in 1937 by Chester F. Carlson and developed by the Battelle Memorial Institute and The Haloid Company (now Xerox Corporation). A xerographic plate consists of an electrically conductive back with a photoconductive surface. This plate, electrostatically charged, will, when exposed to an image, discharge more in the bright areas and retain a latent electrostatic image. Such an image can be made visible by depositing electrically charged particles of appropriate color, or by other means.

A powder image on a reusable photoconductor, such as selenium, is electrostatically or adhesively transferred to a final support such as paper and stabilized by heat or solvent vapors. Image effects range from line copy through X-ray images to continuous-tone photographs. The selenium plate uses a vitreous form that is primarily sensitive to blue-green light, with a photographic speed of ASA 4. Panchromatic plates of

faster speed have been made. The other common form of photoconductor is a suspension of zinc oxide crystals in plastic, usually coated on paper made hygroscopic by various additives.

In "xerotyping," a permanent insulating image is charged, xerographically developed, and the powder image transferred to paper at speeds up to 1,200 feet per minute.



How xerography works. (1) Surface of specially coated plate is electrically charged as it passes under wires. (2) Coating of plate charged with positive electricity. (3) Copy (E) is projected through lens in camera. Plus marks show projected image with positive charges. Positive charges disappear in areas exposed to light as shown by white space. (4) A negatively charged powder adheres to positively charged image. (5) After powder treatment (4) a sheet of paper is placed over plate, and receives positive charge. (6) Positively charged paper attracts powder from plate, forming direct positive image. (7) Print is heated for a few seconds to fuse powder and form permanent print.

High-contrast xerography can be used to copy documents, microfilm (negative or positive).

maps, cathode-ray images, and galvanometer recording, and to make lantern slides or printed electric circuits. Paper or metal plates for offset lithography can be made, as can masters for spirit duplicators (hectograph).

HARRY L. GAGE.

**XEROPHTHALMIA**, zê-rôf-thâl'mî-ə, or **XEROSIS**, zî-rô'sis, a degenerative condition with characteristic dryness of the conjunctiva and cornea of the human eye. The dryness is not due to diminution of the tear fluid, but rather to tissue changes. Normally the conjunctiva is moistened by its own secretion from the accessory lacrimal glands of Wolfring and Krause, also from the secretion of the goblet cells; therefore removal of the main lacrimal gland does not lead necessarily to xerophthalmia. But even in the presence of copious lacrimal secretion, degenerative processes, either of local or systemic origin may cause xerophthalmia. Xerophthalmia or xerosis is not a disease, but is a symptom and may be the sequel of local disease, or a symptom of general disease.

**Local Disease.**—In cicatricial (scarring) degeneration of the conjunctiva due to trachoma, pemphigus, extensive burns or other conditions, the subconjunctival tissue is replaced by scar tissue, thus eliminating the self-lubricating capability of the conjunctiva. Also, exposure of the mucous membrane (conjunctiva) constantly to air, as in lagophthalmos (paralysis of the eyelid muscles), will cause xerophthalmia, which with the ensuing tissue changes (keratinization) of the mucous membrane will endanger the health of the entire anterior segment of the eye.

**General Disease.**—Xerophthalmia is part of a complex of symptoms resulting from malnutrition in general and vitamin A deficiency in particular. Characteristic changes involve the mucous membranes and the epithelium of the skin. The medullated nerve fibers are also undergoing degeneration, both centrally and peripherally.

The eye symptoms vary from mild dryness (xerosis) of the conjunctiva, with mild night blindness, to severe dryness and tissue changes in the conjunctiva and cornea. Night blindness might be severe. In advanced stages of xerophthalmia the cornea may be destroyed by keratomalacia (severe degeneration of corneal tissues), followed by corneal ulcers. The inner eye is then open to severe infections which may involve and

destroy the entire eyeball (panophthalmitis). Lens opacities (cataract) have been reported in some of the cases where the course of the disease was prolonged. Early symptoms in the eye include lack of luster and wrinkling of the conjunctiva. Small white foamy patches, first oval, later triangular in shape, appear on the conjunctiva, especially on the temporal side in the area which is exposed to air; they are called Bitot's spots. Tear fluid will not wet these patches, which are usually found in both eyes. They are named after the French physician, Pierre Bitot, who gave the best-known description of the condition in modern times (1863). The symptom complex of which xerophthalmia is a part has been well known since ancient times. It was accurately described by Aulus Cornelius Celsus (about 25 A.D.) and its description can be found in an Egyptian papyrus from the 19th century B.C. In exceptional cases, persons in robust health will exhibit the symptoms of xerophthalmia, but usually it is seen only in patients who have mild to severe malnutrition.

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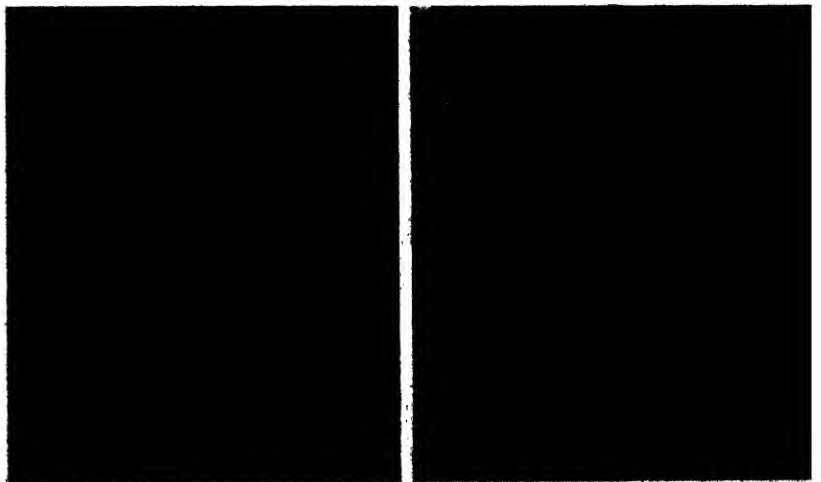
**XEROPHYTE**, zê'rə-fit, any of numerous plants which can endure recurrent drought by means of special structural and functional adaptations, notably by a remarkable resistance to wilting. Although many xerophytes are found in deserts (comprising about one fifth of the earth's surface), they are not confined to such areas. Algae, fungi, lichens, and mosses, growing on tree barks or rocks, are as typical xerophytes as are the well-known members of the predominantly American cactus family (Cactaceae) and certain Old World (African) members of the spurge family (Euphorbiaceae). Probably all xerophytes have arisen independently of mesophytes (plants growing under less extreme conditions), and are more numerous and diversified than hydrophytes (aquatic plants).

Three general types of xerophytes can be recognized:

(1) Ephemeral annuals. These plants, which are small and numerous in arid regions, survive the long dry season as seeds after completing their life cycles during the few (four to six) rainy weeks.

Xerophytes, left to right: Lichens are developed through the effect on each other of two different kinds of plants that grow together. The plant called hen and chickens increases by sending out small buds.

T. H. Everett; Roche



(2) Succulents. These plants are equipped with water-storage tissue (fleshy roots, stems, or leaves) in which they accumulate large amounts of water during the rainy season. The cells of this tissue swell up a great deal. The shallow root system of cacti enables them to accumulate the minute quantities of water penetrating the upper inches of soil. In addition to other protective devices, succulents are able to keep their stomata closed during the daytime and open at night, thus considerably reducing further loss of water. They may lose 25 percent or more of their stored water and remain alive. Succulence is retained by limited use of stored water, since transpiration rates are generally very low when outside water is not available. Included in this group of plants, many of which are frequently seen in cultivation—are such plants as cacti, century plant, aloes, and stapelias.

(3) Nonsucculent perennials. This group is able to endure periods of permanent wilting; such periods are always short in the case of most woody plants, but may last months or years in the case of grasses and other herbaceous plants. Outstanding adaptations of the nonsucculent perennials are: rapid elongation of the seedling taproots prior to desiccation of the soil; extensive root systems in proportion to shoot systems (mesquite roots may descend to a depth of 65 feet and alfalfa roots may reach 130 feet); minimum transpiration during permanent wilting, due to shedding of leaves; heavily cutinized or waxy evergreen leaves (as in sclerophylls, or hard-leaved plants); sunken or otherwise protected stomata; small leaf blades (microphyllous plants); vestigial leaves; loss of leaves, reduction in size of individual cells; high osmotic pressure; and endurance of desiccation, which is an adaptation that can be seen in the ability of algae, fungi, lichens, and mosses to remain alive in air-dry condition for considerable periods of time.

Although xerophytes in general are marked by many structural and functional adaptations, no combination of these is characteristic of all of them. Actually, each xerophyte maintains its water balance through its own combination of adaptive characters.

THEODOR JUST.

**XEROTHERMIC THEORY**, zê-râ-thûr'mîk thê'ô-rî. The term "xerothermic" was suggested in 1891 by the Swiss, John Isaak Briquet, to designate a climatic period occurring after retreat of the last great continental glaciers that had apparently been drier and warmer than that of the present. Louis Agassiz, in 1837, had presented evidence for the former existence of these glaciers over much of North America and Europe. Once this idea was accepted in the scientific world, the simplest explanation of climatic change was that there had been a gradual warming from glacial times down to the present. Ultimately, doubt was cast upon this assumption, however, by subsequent studies of animal fossils and the layers of plant remains that had accumulated in old lake beds as peat. In addition, there was an increasing knowledge of the present distribution of plant species.

Peat deposits are especially abundant in regions that once were covered by glacial ice. Beginning in 1842 much attention was given to the remains of vegetation found in successive layers of peat, especially in Scandinavia. As a result it became clear that above the lower layers of cold-

climate species, such as spruce, there were remains of other kinds, such as oak, mistletoe, and ivy, that thrive today in warmer regions than those in which they were laid down. Above them was a marked increase in the species that are found living under the present, evidently somewhat cooler climate. There was, however, a considerable amount of controversy, both as to the details of this record as well as to their method of interpretation.

The second reason for believing in a post-glacial xerothermic period (or periods) came from the presence of steppe plants surviving in parts of Europe whose characteristic climate favors forest rather than grassland. In North America there are similar areas of grassland, despite a forest climate such as that of Ohio. Henry Allan Gleason, in 1915, discussing the presence in Illinois of communities of arid-climate species, advanced the explanation that they were relicts—surviving remnants of a type of vegetation much more abundant during a former drier and warmer phase of climate.

Impressive as these two lines of evidence were, debate continued. This is why the term "theory" has been employed, pending more positive proof. Supporting evidence became possible with the development, by the Swedish scientist Ernst J. Lennart von Post in 1915, of a technique known as pollen analysis. Since windblown pollen is deposited in large amounts in lake sediments, one can, by coring these sediments and identifying and counting the different kinds of pollen therein, get a useful notion of the trends in adjacent vegetation, and from it infer climatic changes.

Thus a typical deposit in the Great Lakes region of North America reveals the following sequence, from bottom to top, based upon the changing proportions of pollen: spruce, pine, hemlock, oak and hickory, beech and maple. Knowing the moisture and temperature requirements of these forest types, we can be reasonably certain that the intervals of pine and the later oak-hickory were relatively drier than the other three. They were also clearly warmer than the initial spruce interval and very probably warmer than the climate of today, as well as drier. Acceptance of this idea by geologists, at least so far as temperature is concerned, is reflected in their use of the term "altithermal" and the more recently coined "hypsiethermal."

Willard Frank Libby's discovery of the method of dating organic materials by the use of radioactive carbon (see **RADIOCARBON DATING**) has made it possible to approximate the time scale of these changes, confining them to the last 10,000 years. Further refinements almost certainly will enable us to factor out the effects of moisture and temperature more closely than at present. Meanwhile, we know that the gradient from cool-moist (oceanic) to warm-dry (continental) climate in North America runs from northeast to southwest, and that climates in the past have shifted back and forth along the line of this diagonal. Plants and animals have changed their distribution accordingly, and so doubtless have the activities of prehistoric man.

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**XERXES I**, zûrk'sêz (called **THE GREAT**; Persian **KHSHAYARSHA**), king of Persia: d. Susa, Persia, 465 B.C.; r. 486–465 B.C. He was a son of Darius I

Hystaspis (Darius the Great) and Atossa, daughter of Cyrus the Great. He prepared (483-481) to execute his father's thwarted plan to conquer Greece by inducing Carthage to attempt the conquest of Sicily, held by colonial Greeks; by securing support from several mainland Greek city-states; and by assembling an enormous army and armada to invade Greece.

Although Greek tradition grossly exaggerated the Persian forces—which it set usually at 2,641,610 soldiers and sailors of more than 50 nationalities (excluding all sorts of camp followers) and 4,207 ships—yet the Persians definitely outnumbered the Greeks. Most modern scholars have produced estimates that reduce the effective Persian strength to an army of 180,000 soldiers and a naval force of 600 ships.

Xerxes mustered his army at Sardis in Asia Minor (480), crossed the Hellespont (Dardanelles) by a bridge of boats, and penetrated Greece as far as Thermopylae in Locris. His fleet anchored off Artemisium in Euboea. Persian victories at both places (480) led to the devastation of Attica and the destruction of Athens. After the Persian naval defeat off Salamis in the Saronic Gulf (480), Xerxes returned to Asia. His army was conquered at Plataea in Boeotia (479) on traditionally the same day that the rest of his fleet was routed off Mycale in Asia Minor.

Xerxes then seems to have surrendered himself to such debauchery that his subjects were disgusted, and his guards eventually murdered him in a palace intrigue.

The occasional identification of Xerxes with Ahasuerus in the Biblical books of Ezra and Esther is erroneous, as shown by chronological data.

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**Further Reading:** Burn, A. R., *Persia and the Greeks: The Defense of the West, c. 546-478 B.C.* (1962; reprint Stanford Univ. Press 1984); Hignett, Charles, *Xerxes' Invasion of Greece* (Oxford 1963); Olmstead, Arthur T., *A History of the Persian Empire* (Univ. of Chicago Press 1959).

**XI JIANG**, or "West River." It is the longest river in southern China. See **SI KIANG**.

**XIAMEN**, China. See **AMOY**.

**XIAN**, China. See **SIAN**.

**XIAN**, China. It is the capital of Shaanxi (Shensi) province. See **SIAN**.

**XIMÉNEZ DE CISNEROS, Francisco**. See **JIMÉNEZ DE CISNEROS, FRANCISCO**.

**XIMÉNEZ DE QUESADA, Gonzalo**. See **JIMÉNEZ DE QUESADA, GONZALO**.

**XIMENIA**, zī-mē'nī-ə, a pantropical genus of the plant family Olacaceae, consisting of approximately 10 species. However, some or all of the species may be merely variants of *X. americana*. Depending upon the environment, this species is a tree or shrub, usually with thorns in the axil of the leaves.

*Ximения* is a semiparasite, most frequently found throughout the tropics along the coast, but it may also occur inland. The wood is aromatic, close-grained, and yellow, and can be used as a substitute for sandalwood; hence one of its common names, false sandalwood. The bark yields tannin. Leaves are oblong to elliptic, alternate, and entire. The small, fragrant flowers grow in

axillary clusters. There are four petals, yellow to yellowish white in color, and densely hairy within. The fruit is yellowish and smooth, about one half to an inch long, with acid sweet pulp; before the fruit ripens it has an odor like that of oil of almonds. Prussic acid has been obtained from the ripened fruit. The single large seed contains an oil that can be used for soap making and lubrication.

Authorities differ as to whether the seeds are edible or are purgative. Some of the common names of the plant are hog plum (Florida); sea-side plum, ciruelillo, and limoncilla (Cuba); tal-low wood, manzanillo (El Salvador, Honduras, and Guatemala); bedara laut malaya, citron de mer (French colonies); and ciruelo (Columbia and Cuba).

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**XINGU RIVER**, shēng-gōo, river, Brazil, a principal right-hand tributary of the Amazon. Several streams rising in the Serra do Roncador, a range in central Mato Grosso State, combine to form the river, which flows north through Pará State and joins the Amazon delta at its head below Porto de Moz. Broken by falls and rapids, much of its course is unexplored. It is 1,230 miles (1,980 km) long, but only its lower 100 miles (160 km) is navigable.

**XIPHILINUS**, zī-fī'lī-nūs, **Joannes**, name of two Greek clergymen:

(1) Patriarch of Constantinople (1064-1075), a native of Trabzon in Asia Minor, composed several constitutions on ecclesiastical matters and some orations of theological interest. He often is confused with his nephew (2).

(2) Monk in Constantinople (fl. 1075), also from Trabzon and nephew of the patriarch (1). He abridged books 36-80 of the *Roman History* of Dio Cassius. His somewhat careless abridgement omitted many important statements which Joannes Zonaras (fl. 1120), a later epitomizer, preserved. Each epitome is printed with Dio Cassius' work.

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**XOCHICALCO**, sō-chī-kāl'kō, Mexico, an extensive archaeological site lying slightly southwest of Cuernavaca in the State of Morelos, regarded as belonging to the finest pre-Hispanic Mexican period. It dates from the 2d century B. C. to the 9th century A. D., and has some characteristics (especially a large ball court) which are similar to Maya ruins. Some workers think that it is, in fact, a Maya city later taken over by the Mexicans of the high plateau; others believe that it was a Toltec stronghold built to resist an Olmec invasion from the east. The chief pyramid is almost the only construction with relief sculpture, and the design shows the Quetzalcoatl (Feathered Serpent) motif. See also Mexico—*History*.

IRENE NICHOLSON  
*Author of "Conquest of Mexico"*

**XOCHIMILCO**, sō-chī-mēl'kō, Mexico, a suburb of Mexico City, 10 miles (16 km) south of the center of the capital.

It is situated on the shores of Lake Xochimilco, one of the few areas of water remaining from the ancient highland lake district of the central plateau. In the ancient Nahuatl tongue the



name means "Place of Flowers"; but the conquering armies of Hernán Cortés, forced back from the causeways into the water as they fought the defending Aztecs (1520), must have found the name ironical. Here the Indians had long raised flowers, vegetables, and fruits on rafts called *chinamoas*, made of interwoven twigs and reeds covered with mud. In the course of time the roots of the plants became attached to the bottom of the shallow lake and fixed the rafts to the mud. Hence the modern epithet of "floating gardens," although the present-day appearance is rather of raised meadows intersected by canals lined with poplars, flowers, and other plants. The gardens are a popular picnic and boating site for tourists, both Mexican and foreign, who traverse the waterways in a variety of craft, especially in the canoes called *trafineras*. These boats, punted with long oars, are decorated with arches of flowers and usually contain at least one guitarist—all contributing to a festive scene which contrasts sharply with the surrounding slums. (Since Xochimilco is considered part of the Federal District, separate population figures are not announced.)

IRENE NICHOLSON.

**XOCHIPILLI**, sô-chî-pē'li, Nahuatl god of flowers and patron of games, dance, and sport. A particularly fine and much-reproduced statue in the National Museum of Mexico shows him seated cross-legged on an elaborately carved pedestal, with carvings of flowers and other symbols on his legs and chest. In a drawing in the *Codex Magliabecchiano* he is wearing an eagle headdress and is being borne on a flowery litter by two serfs, preceded by a singer and conch blower. An ancient feast was dedicated to him and his consort Xochiquetzal.

IRENE NICHOLSON.

**X-RAY ASTRONOMY**, eks'rā əs-tron'ə-mē, is the study of radiation from celestial objects at spectral wavelengths shorter than 100 angstroms. The earth's atmosphere permits only small amounts of X-radiation to penetrate to the surface, so such studies require observations to be made from rockets, satellites, and high-altitude balloons.

Different kinds of objects in space emit X-radiation, including the sun, some stars, and supernovae. There are many unidentified sources and also a diffuse background that may be associated with radiation from other galaxies. The solar X-radiation appears to be of two kinds: a quasi-steady background and transient bursts associated with solar flares. Solar X-rays play an important part in the formation of the earth's ionosphere.

A rocket flight in 1962 detected a discrete source beyond the solar system for the first time, in the direction of the constellation Scorpius. Since then approximately 40 sources have been found. Most of them lie close to the plane of our galaxy and cluster in two regions—toward the galactic center and in the constellation Cygnus. Of the few sources that have been identified with visible objects, nearly all are associated with old supernovae. Different sources produce various kinds of X-rays, and some sources are variable in brightness. Determination of the nature of these sources must await information provided by larger observational instruments in more sophisticated space vehicles.

NANCY W. BOGGESS

National Aeronautics and Space Administration

**X-RAYS**, eks'rāz, invisible, highly radiations similar in nature to visible much shorter wavelength, ranging from  $10^{-7}$  (0.0000001) to  $10^{-3}$  (0.000000001) centimeter (cm). The designation "X"—for "unknown"—was used in 1895 by the discoverer of X-rays, Wilhelm Conrad Roentgen, because he was not then certain of their nature. X-rays, sometimes called roentgen rays, are now known to constitute a part of the electromagnetic spectrum of radiation, which also includes light waves, radio waves, ultraviolet waves, infrared or heat waves, microwaves, and gamma rays. X-rays are emitted from atoms as a result of specific rearrangements (energy transitions) of atomic electrons, and are produced in commercial X-ray tubes by bombarding a metallic target with a beam of high-velocity electrons. X-rays also occur in solar radiation and in other extraterrestrial radiations.

Roentgen found, among other things, that X-rays can penetrate matter opaque to visible light, and that, like visible light, they can activate photographic films and fluorescent screens. In 1912 other physicists discovered that crystalline solids (for example, metals and metallic salts) act as natural diffraction gratings for X-rays because X-ray wavelengths are of the order of magnitude of the dimensions of crystal lattices. A typical X-ray wavelength used in diffraction is 1 angstrom, or  $10^{-8}$  cm, which is about  $\frac{1}{4000}$  the wavelength of yellow light.

The medical applications of X-rays stem from the aforementioned discoveries by Roentgen, and from the fact that X-rays can destroy diseased body tissues, for example, tumors. To the physicist, the discovery of X-ray diffraction initiated the vital role played by X-rays in determining the structure of matter. The statement by Sir Arthur Eddington that, prior to the discovery and extensive application of X-ray diffraction, more was known about the interior of a star than about the interior of a table, was not an exaggeration.

This article is organized as follows:

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## 1. Physics of X-Rays

**Roentgen's Experiments.**—X-rays were discovered by Roentgen, a professor of physics, on Nov. 8, 1895, at the Royal University of Würzburg in the German town of that name. Roentgen was experimenting with a primitive vacuum tube, then known variously as a Hittorf, a Crookes, or a Lenard tube, which was essentially a pear-shaped glass bulb provided with two metallic electrical-conducting terminals, called a cathode and an anode, hermetically sealed through the walls of the bulb. The cathode inside the bulb usually took the form of a small concave metal disk on the inner end of a metal stem passing through the neck of the pear-shaped bulb in a way not unlike the actual stem in the fruit. The other terminal, the anode, was usually sealed through the glass on one side of the pear at a point where a small teat-shaped projection for this purpose was blown into the glass wall.

The air pressure in such a bulb was reduced to the order of one millionth of normal atmospheric pressure by means of a vacuum pump. If the terminals of the tube were then connected to a source of high-voltage electric current, the cathode being connected to the negative terminal, the

Rotation radiation, a method of treating deep-seated cancer, requires the use of a 2 million-volt X-ray machine. The chair is rotated while the X-ray shoots its cell-destroying rays into the cancer. Surrounding tissues receive only a fraction of the radiation, while the center of the target gets the maximum effect.

American Cancer Society

glass walls of the tube, particularly at the opposite end of the bulb from the cathode, would be seen in the dark to emit a green fluorescent glow.

Roentgen was experimenting with such a tube completely enclosed in an opaque black cardboard box when he happened to notice that a fluorescent screen lying on the bench nearby and consisting of a piece of paper coated with the chemical substance barium platinocyanide, emitted light when and only when the tube inside the cardboard box was being supplied with the high-voltage electric current. After interposing various objects between the tube and the fluorescent screen, he concluded that its fluorescence must be produced by an invisible radiation traveling in straight paths from the tube to the screen. He showed that shadows could be cast in the fluorescent illumination of the screen by many objects, particularly heavy metals such as lead, which clearly absorbed the invisible rays much more completely than some lighter substances such as wood, cardboard, paper, or aluminum. He reported that "behind a bound book of about one thousand pages I saw the fluorescent screen light up brightly, the printer's ink offering scarcely a noticeable hindrance." The bones in his own hand cast shadows on the screen, while the rays passed easily through the flesh.

In the short space of scarcely more than two weeks, with very rudimentary equipment and with astonishing ingenuity, Roentgen performed a series of brilliant experiments that established, in broad outline at least, a large fraction of all the basic qualitative phenomena connected with X-rays.

News of the discovery spread through the world like wildfire, and applications were made almost immediately, especially in the realm of

medical diagnosis. In retrospect it is clear, however, that the discovery had far greater significance in the realm of physical research than in any of these immediate applications. It marked the opening of the era of what came to be called "modern physics," a period during which man's understanding, control, and use of the submicroscopic features of the world of nature—molecules, atoms, electrons, nuclei and their constituents—were developed to an astonishing degree. In this development of our physical knowledge of the world through research, the rays discovered by Roentgen have played one of the central roles.

**Cathode Rays.**—Rapidly moving electrons called cathode rays were already known to be produced in vacuum tubes such as Roentgen used, and in fact in Philipp Lenard's form of the tube a sufficiently thin window was provided to allow the cathode rays to stream out into the air. But Roentgen established that X-rays were also generated on the inner surfaces of the glass walls of the Hittorf or Crookes vacuum tube wherever these surfaces were bombarded with the cathode rays, the stream of rapidly moving electrons.

Provisionally we may conceive an electron as a small particle with a single unit of negative electric charge ( $e = 4.803 \times 10^{-10}$  absolute electrostatic units) and with a mass of  $9.1 \times 10^{-28}$  gram. Electrons exist in huge numbers in all forms of matter. Swarms of them form the outer cloaks surrounding the nuclei of all atoms, where their characteristic motions, configurations, and energies of attachment account for most of the characteristic chemical and physical properties possessed by the chemical elements.

The electrons that bombarded the walls of Roentgen's tube are not to be confused with the X-rays they produced at their point of impact.

The electrons came chiefly from the cathode terminal of the Crookes tube. Most of the electrical energy supplied from the high-voltage generator to the terminals of the tube resulted in imparting high velocities (kinetic energy) to these electrons, and this energy was chiefly released as heat to the glass walls wherever they received the electron bombardment. Such heat could and frequently did melt the glass envelope. (Ordinarily only a fraction of 1 percent of the energy input is converted into X-rays.)

The source of supply of electrons in the earliest tubes was maintained by literally splashing them out of the cathode through bombardment of the latter by positive ions created in the residual gas of the tube by the electrical discharge itself. The operation of such gas-filled tubes was thus quite sensitive to small changes in the low residual gas pressure and therefore undesirably erratic. The X-ray tube, in consequence, passed through an evolution. At an early stage a refractory metal target was provided inside the vacuum envelope. The bulk of the cathode rays could strike against the surface of this target in a small, rather concentrated focal spot that had various provisions to remove the heat generated there by the bombardment. This focal spot then became the source from which the X-rays came. At another stage William David Coolidge found a way to dispense with the gas as a means of obtaining electrons from the cathode and to provide an electron discharge supplied by a cathode filament kept hot by a source of electric current.

**X-Ray Spectra.**—When the rapidly moving electrons are suddenly stopped by the metal target, the impact produces a mixture of X-rays of two distinct categories: (1) a line spectrum of X-rays characteristic of the material of which the target is composed, superposed upon (2) a continuous spectrum of X-rays in which all wavelengths or frequencies are present throughout. The latter range from wavelengths so long that they are absorbed completely in the glass walls or the exit window of the tube, to wavelengths having a well-defined upper limiting frequency (and lower limiting wavelength) beyond which there are no X-rays whatever at shorter wavelengths or higher frequencies. This upper frequency limit is called the quantum limit of the continuous X-ray spectrum.

As the preceding statements imply, X-rays exhibit all the characteristics of a transverse undulatory electromagnetic-wave phenomenon and indeed constitute a region of the general spectrum of electromagnetic radiations to which also belong the regions of radio waves, infrared radiation, visible light, ultraviolet light, and nuclear gamma rays. These various regions merge indistinguishably into one another, differing only in regard to one quality that may be described as the wavelength,  $\lambda$ , the frequency,  $\nu$ , or the quantum energy,  $h\nu$ , of the radiation; for it has been found that whenever radiation interacts with matter it always does so in discrete amounts or bundles of energy called quanta. The wavelengths of X-rays range from about  $10^{-9}$  to about  $10^{-12}$  meter.

In all phenomena of wave propagation the product of the frequency,  $\nu$ , by the wavelength,  $\lambda$ , gives the phase velocity of the radiation. The phase velocity of all electromagnetic radiation in free space (vacuum) is  $c = 299,792$  kilometers per second. The quantum energy of the radiation is proportional to the frequency, and the ratio be-

tween quantum energy and frequency is Max Planck's famous universal constant,  $h$ . A convenient conversion rule follows from this: If we divide the constant number  $12,398 \times 10^{-8}$  by either (1) quantum energy expressed in electron volts<sup>1</sup> or (2) wavelength,  $\lambda$ , expressed in centimeters, we obtain the other of these two quantities.

It soon became apparent that the continuous spectrum from X-ray tubes operating at higher applied voltages exhibited superior power of penetrating material screens. Such penetrating X-rays were called in the beginning "hard" X-rays. Less penetrating radiation was said to be "softer." These names have been retained in use, but it later came to be understood that "hard" radiation is more penetrating because it is shorter in wavelength (or higher in frequency or in quantum energy). It has been found that, save for certain important abrupt deviations (called absorption discontinuities), each atom of a given atomic number  $Z$  (see section 1. *Physics of X-Rays*—Moseley's Atomic Numbers) absorbs X-rays to an extent that varies approximately as the cube of the wavelength and as the fourth power of the atomic number.

**Generation of the Continuous Spectrum.**—To form a clearer picture of how the continuous X-ray spectrum is generated in the target, let us imagine the structure of this metal target on a scale of linear dimensions ten billion times natural size. Each atom would then be about the size of a moderately large room and the nucleus of the atom in the middle of that room would be about the size of a pinhead. In spite of the relatively tiny size of the nucleus, almost the entire mass ("weight") of the atom is nevertheless concentrated therein. With the increase in size we have envisioned, if our pinhead had the same matter density as actual nuclei possess it would have the fantastic mass of two tons, even if it were the lightest of all nuclei (a proton). If it were a tungsten atom (tungsten is a heavy refractory metal frequently used for X-ray tube targets), the pinhead nucleus would weigh about 370 tons.

The rest of the atom, the great bulk of the space in our room, would be occupied only by the atomic electrons. For each tungsten atom there would be 74 of these electrons, which we might picture as darting rapidly about in the room with terrific velocity like a cloud of extremely agile gnats or other insects, so that all parts of the room would be continuously explored by them with great rapidity.

We must be careful not to push the analogy too far. Although the electrons, like the gnats, have little mass compared to the nucleus, unlike the gnats they are bound to the nucleus by, and repel each other with, gigantic forces. They also have other far less familiar wavelike properties that profoundly affect and condition the behavior of a given electron in terms of the behaviors of neighboring electrons. Thus, although most of the mass (370 tons) of our tungsten atom is in the little pinhead nucleus and the rest of the room (atom) is in a sense almost empty space, that space is highly forbidden ground for encroachment by the similar parts of any neighboring tungsten atoms.

<sup>1</sup> A convenient unit of energy in physics is the electron volt. It is the energy acquired by an electron when the electron is accelerated through a potential difference of one volt and is equivalent to  $1.6021 \times 10^{-12}$  erg or  $1.6021 \times 10^{-19}$  watt-second.

One of the important duties that the electrons accomplish in their ceaseless flying about is, through their force fields, to ensure the rigidity of the three-dimensional atomic latticework that constitutes the structure of any solid (in our present case, tungsten). Fast electrons accelerated by X-ray tube voltages of tens or hundreds of kilovolts can, however, be driven at high speed through such a structure, although the energy transferred from the fast electron to the atomic electrons is very high (of the order of one to ten million electron volts per centimeter of its path).

We may picture one of these fast electrons from the X-ray tube cathode being driven into the heart of the tungsten target by the high voltage with which it has been impelled against it and weaving its way through the cloud of electronic gnats. At the center of each atom (our "room") through which this dashing visitor passes is the tiny pinhead 370-ton nucleus, which (in the case of tungsten) has a positive charge some 74 times as great as an electron and, of course, of opposite sign. If the fast electron passes this positively charged nucleus at some distance from it, there will be enough negatively charged electrons between the two to shield the fast electron considerably from the strong attraction of the nucleus; but occasionally, by chance, the fast electron may pass close enough to the nucleus to be strongly deflected by its attraction. When such an event occurs, the impulsive kick or acceleration that the fast electron experiences will cause some (perhaps a substantial fraction) of its kinetic energy to be converted into a quantum of electromagnetic radiation in accord with the principle that any charged body that experiences an acceleration can be expected to emit electromagnetic radiation.

In the case of a head-on collision between a fast electron from the X-ray tube cathode and a tungsten nucleus, the maximum possible energy available to be converted into a quantum (photon) of radiation is the entire kinetic energy of the bombarding electron, an energy which, if expressed in electron volts, is essentially equal numerically to the voltage applied to the terminals of the X-ray tube. The photons of radiation constituting that part of the continuous spectrum of X-rays that appears at its quantum limit (the highest frequency, or shortest wavelength, of the spectrum) are formed by such head-on collisions with nuclei at the very surface of the target. In these collisions the entire kinetic energy of the fast electron, before it has had an opportunity to be dissipated in any other way, is converted completely in a single elementary process into a quantum of X-radiation. Between this most favorable (but rare) case of 100-percent conversion and the cases of more distant interactions between electrons and nuclei in which only a small fraction of the kinetic energy is so converted, all gradations are possible. This explains the presence of an entire continuum of wavelengths, frequencies, or quantum energies in the continuous X-ray spectrum.

The line spectrum, which is also emitted by X-ray tubes, is found to consist of several series of distinct, well-defined lines whose wavelengths, frequencies, or quantum energies depend on the particular atoms of which the target is made. These lines, in fact, represent the characteristic response made by the electron "gnats" surrounding the atoms of the target to the disturbance created among them by the passage of the bombarding cathode-ray electrons.

**Laue Spots.**—An advance of tremendous importance was made in 1912 when at the suggestion of Professor Max von Laue in Munich the two physicists W. Friedrich and P. Knipping tried directing a fine pencil of X-rays at a crystal of zinc blende (zinc sulfide). They found that the X-rays were "reflected" in a large number of well-defined directions by the crystal so as to form a regular pattern of spots (now known as Laue spots) on a photographic emulsion placed in the vicinity. It rapidly became evident that a similar phenomenon could be expected for any crystal, the pattern of spots being closely related to the atomic latticework structure of the crystal. The analytically correct but somewhat intricate explanation of these spots given by von Laue became much easier to understand intuitively after the work of William Henry and William Lawrence Bragg (father and son) in England the following year.

To understand this we need to explain briefly what has been revealed, chiefly by studies with X-rays, about the structure of crystals. It is found that the atoms in a crystal arrange themselves in three-dimensional latticework patterns of which one of the simplest, the only one we shall describe, is that of rock salt (consisting of sodium and chlorine atoms in equal numbers). Picture a plane surface dotted with sodium and chlorine atoms in an alternate square array, such as one would obtain if the center of each black square of a checkerboard were occupied by a sodium atom and the center of each white square by a chlorine atom. Next, picture a three-dimensional array consisting of such checkerboards piled upon one another in layers so adjusted that each sodium atom has a chlorine atom just above and below it and each chlorine a sodium just above and below it. In the case of sodium chloride the vertical separation between adjacent layers is the same as the horizontal separation between adjacent atoms in each square array. (In the actual crystal the atoms support each other in this rigid array through the force fields set up by their respective electronic structures; there is, of course, no question of tangible surfaces or checkerboards other than as a help to the imagination.)

Anyone who has looked from a railway train at a grape vineyard or an orchard of fruit trees laid out in regular square array will recall how the vines or trees not only align themselves in two mutually rectangular directions but also form straight rows in a great number of other directions as well. With a little imagination it will be easy to see that, in the three-dimensional atomic crystal lattices, there will in a similar way be a great number of differently directed plane surfaces that can be passed through the latticework in uniformly and densely studded patterns of atoms; and that, for every plane so tilted, there will in fact be an infinite number of other planes parallel to the one in question for which the same will be true. Each such set of parallel planes will constitute a layered array in which all adjacent pairs of planes have the same common interplanar spacing, although the spacing may be different for differently tilted arrays.

In Laue, Friedrich, and Knipping's experiment, each of these differently tilted arrays of planes accounted for each of the differently directed Laue-spot reflections of the primary beam. It is important, however, to understand that not any X-ray wavelength would be so reflected if it fell at an arbitrary angle upon a set of planes of

arbitrary spacing. The reflection is strong only when a certain relation, known as the Bragg condition, holds between the wavelength,  $\lambda$ , the angle of glancing incidence on the planes,  $\theta$ , and the interplanar spacing,  $d$ . The relation is  $n\lambda = 2d \sin \theta$ , where  $n$  is a small whole number called the "order" of the reflection.

This Bragg condition is the analytical statement of the requirement that the X-ray wavelets emitted from a specified distant source point, after reflection by the planes (as though each were a mirror), must recombine at another distant observation point in exact phase coincidence. This occurs because the path traversed by an X-ray wavelet reflected by any one plane differs from that of a wavelet reflected by a neighboring plane by exactly a whole number of X-ray wavelengths. An X-ray of any wavelength  $\lambda$ , incident on a specified array of planes of spacing  $d$  at a specified angle  $\theta$  for which the above Bragg condition is not fulfilled will pass on into (and perhaps through) the crystal until it has been absorbed, but it will not be appreciably reflected. What we have described, therefore, is frequently referred to as "selective reflection." It is easy to see how this principle can be used to analyze the radiation from an X-ray tube into its component wavelengths by studying the X-ray intensities selectively reflected from systems of crystal planes at different reflection angles.

**Moseley's Atomic Numbers.**—The next important step followed rapidly when in 1914 Henry Gwyn-Jeffreys Moseley, in two classic papers applying the principle of selective crystal reflection, presented a systematic study of the characteristic line spectra emitted by targets of various metals when they were subjected to cathode-ray bombardment. Moseley, who began these experiments in 1913, used an X-ray tube of special construction that permitted rapid and convenient substitution of several different target materials. He found that, unlike optical spectra, the characteristic X-ray spectra of atoms are relatively simple, consisting, for a given target element, of widely spaced groups of but a few lines. The groups were recognizable in all the elements examined by Moseley (some 17 elements in his first work). The simple pattern of lines was very much the same in each spectral group over this wide range of elements, save for the actual wavelength position in the spectrum at which a given line occurred; and it was of extreme significance that as Moseley passed from element to element in the periodic table of increasing atomic weights, the wavelength of a given line in the pattern, as observed successively in the spectrum of each element, varied in a regular and quite uniform way with only a few exceptions when plotted as a function of the ordinal number of the element in the series.

Furthermore, Moseley found that, even in the few exceptional cases, a completely uniform behavior of line wavelength as a function of ordinal number could be obtained by exchanging the order of a few adjacent pairs of elements from the original order of increasing atomic weight. Moseley showed that if ordinal numbers  $Z$  (subsequently called the *atomic numbers*) are assigned to the elements in a certain manner, namely, H-1, He-2, Li-3, Be-4, B-5, C-6, N-7, O-8, F-9, Ne-10, Na-11, Mg-12, Al-13, Si-14, P-15, S-16, Cl-17, Ar-18, K-19, Ca-20, and so on to Zn-30, then the square root of the frequency of a given X-ray line from any element is

a linear function of the atomic number (nearly proportional to it, in fact). Although Moseley's assignment of atomic numbers required in a few cases reversal of the generally prevalent order of increasing atomic weight, his numbering system turned out to be actually of much more fundamental significance than the system based on weight; it represents the number of positive unit charges possessed by the nucleus of each atom and therefore is an index of the number of electrons that the nucleus can bind to itself in its outer cloak (see PERIODIC LAW).

Only the year before, in 1913, Niels Bohr had proposed a quantitative model of the hydrogen atom based in part on a general earlier proposal of Lord Ernest Rutherford, who conceived the atom (correctly) as a heavy positively charged nucleus surrounded by a swarm of electrons equal in number and in charge (but of opposite sign; that is, negative) to the nuclear charge. It seemed a safe guess at the time that the swarm of electrons must be in rapid motion because of a mathematical theorem due to Samuel Earnshaw that gave convincing proof that no system of point charges could ever be in static equilibrium under the action of the fields of the charges themselves. On the other hand, according to the electromagnetic theory of radiation propounded by James Clerk Maxwell, any such system of moving charges must radiate electromagnetic waves and hence must lose energy. As a result, the cloud of electrons would be expected to fall inward closer and closer to the nucleus, and it became difficult to see what would place the final limitation upon this catastrophic shrinkage unless some new principle of stability were injected into the picture.

Bohr conceived the electrons as executing orbits about the central nucleus, but added the revolutionary new concept that out of the infinitude of classically possible orbits and energies that such electrons could possess, only certain orbits possessing well-defined energies had the special property of not dissipating their energy into radiation. According to Bohr's proposal, spectral lines were emitted when and only when the electronic orbits executed a transition from one of these nonradiating states to another such state of lower energy, the frequency emitted being given by the energy set free in the transition divided by Planck's quantum of action,  $h$ . Bohr's theory, which has turned out to be one of the major steps of progress in the quantum theory originated by Max Planck, predicted a formula for the wavelengths of the lines to be expected from atoms of atomic number  $Z$ . The formula successfully explained the wavelengths of the lines observed in the spectrum of hydrogen, the simplest of all atoms. Bohr's theory had indeed been constructed precisely for the purpose of explaining these hydrogen lines.

It was a matter of great significance, however, when Moseley showed that Bohr's formula also succeeded in predicting with quantitative success the wavelengths of X-ray lines in the entire series from aluminum ( $Z = 13$ ) to zinc ( $Z = 30$ ), which he had just measured. This was the first strong evidence of any family relationship between the atoms of chemistry, and it was an important opening wedge in the conquest of our understanding of the atomic world.

**Compton Effect.**—The next extremely important fundamental contribution in the field of X-ray research was made by Arthur Holly Compton in 1923. Physicists had already recognized



two distinct processes whereby matter when illuminated by electromagnetic radiation (light or X-rays) itself reemits radiation. The first of these two processes, sometimes called fluorescence, was thought of as a two-step process. The atom first absorbed the luminous energy in such a manner as to modify the energy states of its electrons so that the electrons would assume new dynamic configurations. One or more electrons might indeed even be completely ejected from the atom, leaving therein an unfilled energy state. The atom was then said to be in an "excited state." Subsequently, then, the atom returned to its original lowest energy state (called the "ground state") and in so doing divested itself of its energy of excitation by emitting luminous frequencies (or wavelengths) *characteristic of the particular atomic species to which it belonged*. Such a process accounted for the spectral "lines" observed in both the visible and in the X-ray spectrum, by which the various atoms of chemistry could be identified. Such radiations were frequently referred to, therefore, as characteristic fluorescent radiations. In the emission process the electrons in the atom were thought of as vibrating freely at their own natural characteristic frequencies, frequencies determined by the particular structural characteristics of the atomic species in question. In some cases the time delay between absorption of the radiant energy and subsequent emission of the characteristic fluorescent radiation was sufficiently long to be easily perceptible. When such was the case the process was called phosphorescence. Both phosphorescence and fluorescence are particular cases of a more general phenomenon called luminescence (q.v.).

The second of the two types of radiation-matter interaction was known as scattering. In this process the wavelength (or frequency) of the reemitted light had, up until the year 1920, always been thought to be identical with the wavelength (or frequency) of the incident light. The process was ascribed to forced vibrations of the atomic electrons induced by the oscillating electromagnetic field of the incident beam of light waves. These vibrating electrons themselves then gave off light waves of the same frequency (or wavelength) as the waves of the incident light beam. The luminous energy in the original light beam would obviously be diverted into new directions by the process just described; hence the use of the term "scattering" (of light or X-rays) to describe the process.

Both of these two quite distinct processes, fluorescence and scattering, had been observed to occur when X-rays encountered matter. The two processes could indeed occur simultaneously, and the relative probabilities that atoms of a given species would (1) absorb and then reemit characteristic fluorescent radiation or (2) scatter the original wavelength had been carefully studied and found to depend according to very definite laws on the atomic number,  $Z$ , and on the wavelength of the original incident radiation. Joseph Alexander Gray in 1920, however, noticed that short-wavelength X-radiation, after being scattered from carbon and other atoms of low atomic number, was somewhat more absorbable than the primary radiation, but still of a "hardness" so clearly related to the primary radiation as to exclude its being a characteristic fluorescent radiation from the scatterer. Compton gave the following daring explanation of this effect. He supposed the bundles of radiation energy,  $h\nu$ , instead of

being associated with spreading waves, to be propagated through space from the source in the form of projectiles. When one of these projectiles (or photons), each with momentum  $h\nu/c$ , was scattered by a loosely bound electron in some low-atomic-number scattering material such as carbon, the electron would recoil under the impact, the more so the larger the angle of scattering and the higher the quantum energy (and hence the momentum) of the projectile. The kinetic energy thus given the electron at the expense of the photon explained the "softening" of the scattered radiation in a completely and quantitatively correct way.

Using characteristic line radiation from a molybdenum-target tube, Compton showed that in the spectrum of the scattered radiation there appeared lines each of which was shifted toward a longer wavelength than its corresponding line in the primary radiation by an amount in complete accord with his theoretical explanation. The recoil electrons were also detected and shown by Compton and A. W. Simon to have the requisite speeds and directions of recoil. Even more than this was ascertained, for Jesse W. M. DuMond and Harry A. Kirkpatrick succeeded in showing that the shifted line just referred to was notably broader than the unshifted line, and this was satisfactorily explained by them (with complete quantitative verification in all respects) to be due to the randomly directed velocities possessed initially by the atomic electrons that scattered the photons. The presumptively dynamic character of the electronic clouds in atoms was thus experimentally verified.

**De Broglie's Wave Theory.**—In the same year (1923) Louis Victor de Broglie made a very bold suggestion regarding electrons, namely, that besides their aspect as particles they might also possess undulatory properties. He came to the conclusion that a stationary electron of mass  $m_0$ , which Albert Einstein had predicted must possess a "rest energy"  $m_0c^2$ , must have associated with it a frequency  $m_0c^2/h$ . He concluded further that a moving electron would behave in many respects like a train or small bundle of plane waves of wavelength  $h/p$ , where  $p$  was its kinetic momentum. Both Einstein's and de Broglie's superlative insights were regarded as fantasies at first. The energy  $m_0c^2$  has since then become only too familiar as a commonplace closely associated with its military application in atomic bombs. Four years later de Broglie's electron waves were actually verified, with quantitative corroboration of his formula, by Clinton Joseph Davisson and Lester Halbert Germer, who showed that electrons were selectively reflected from a single crystal of nickel in just the same manner as explained above for the reflection of X-rays.

Erwin Schrödinger had almost immediately seized upon de Broglie's idea of the electron as a *matter wave*, and with rare skill and insight had refined it in the form of a differential equation that in a sense fused the wavelike properties of the electron with its character as a mass particle obeying the laws of mechanics. From this point of view the stationary states of the electrons in atoms, which Bohr had been obliged to postulate ad hoc, appeared as permanent modes of vibration (standing waves) of a complex quantity,  $\Psi$ , called the probability amplitude, with distinct improvements and clarifications of several puzzling difficulties that had afflicted the simpler Bohr theory.

In 1927 Schrödinger proposed an alternate theory of the Compton effect based entirely on the wave picture of both electrons and photons, in which the initial and final states of the initially free recoiling electron interfere with each other to form a space grating of standing matter waves that reflects undulatory X-radiation like the atomic layers in a crystal. The change in wavelength in this picture of the modified scattering process is ascribed to a Doppler effect (see DOPPLER'S PRINCIPLE) caused by the velocity of recoil of the reflecting space grating. No basis for preferring either Compton's or Schrödinger's viewpoint can be found, and indeed we have here one of the striking examples of *wave-particle duality*, which, thanks to the work of Schrödinger, Werner Heisenberg, Bohr, and others, is now recognized to be a common property of all forms of energy, be it matter or radiation.

The discovery of the Compton effect with its two complementary interpretations, together with the quantum theory of optical and X-ray spectra and the wavelike properties of electrons, led directly to Heisenberg's famous principle of indeterminateness and to Bohr's principles of complementarity and renunciation, discussions of which are beyond the scope of this article. These important ideas form the groundwork of quantum theory, upon which repose most of the advances made in theoretical atomic and nuclear physics during the first half of the 20th century by Bohr, Schrödinger, Heisenberg, Arnold Sommerfeld, Wolfgang Pauli, Paul Adrien Maurice Dirac, Enrico Fermi, and many others. The insight thus gained into the weird subatomic world has obliged us to revise completely our intuitive notions of space, time, and causality, and has brought about one of the most drastic and deep-rooted revolutions in human thinking that has occurred in the entire history of the race. See also ATOM; ELECTRON THEORY; QUANTUM THEORY.

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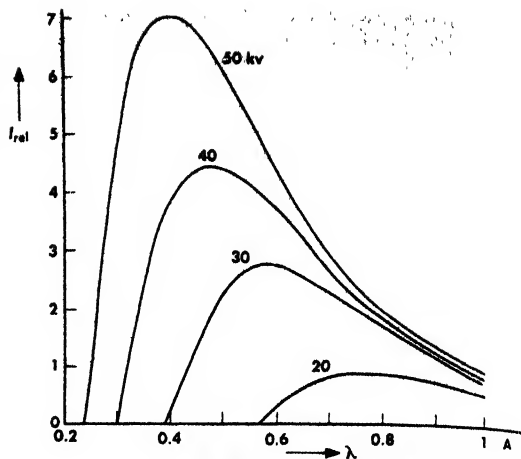
**Continuous and Line Spectra.**—As explained previously, the spectrum produced by an X-ray tube consists of a continuous broad band of wavelengths having a distribution that depends primarily on the voltage applied to the tube (see Fig. 1), and a few sharp, intense characteristic lines whose wavelengths depend on the target element (see Fig. 2). The optical emission spectrum has thousands of lines, whereas the X-ray line spectrum has only a few lines (see Plate 1). The wavelengths of the X-ray lines increase according to simple rules, thereby simplifying their identification.

The continuous spectrum for a given accelerating voltage  $V$  of the electrons begins abruptly at a minimum wavelength  $\lambda_{\min}$ , rises to a broad peak, and falls off gradually with increasing wavelength. The limiting wavelength in angstroms ( $\text{\AA}$ ) is related to the voltage in kilovolts (kv) by the equation

$$V = 12.398/\lambda_{\min} \quad (1)$$

As the voltage is increased, the energy carried by each electron emitted by the filament is increased. This causes the intensity to rise and the spectrum to shift to shorter wavelengths.

The investigations of Charles Glover Barkla and his coworkers, beginning about 1913, showed that the elements possess two types of character-



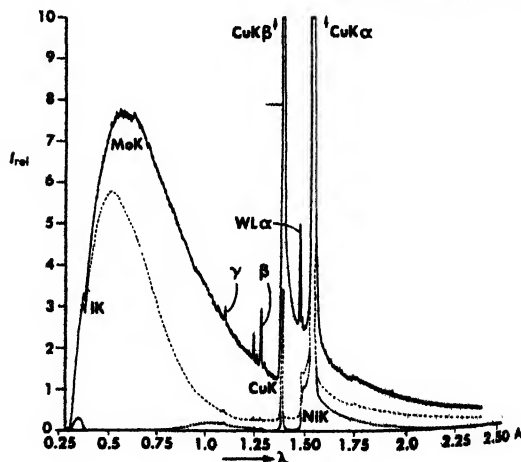
W. Parrish, "Philips Technical Review," 1956

Fig. 1. Continuous spectrum of tungsten-target X-ray tube (relative intensity  $I_{\text{rel}}$  v. wavelength  $\lambda$ ) obtained with various voltages (peak values) and same X-ray tube current. Measured with silicon crystal analyzer and scintillation counter.

istic (line) radiations, which differ greatly in their penetrating power. Barkla called these K- and L-radiations (the M- and N-radiations or series were discovered later) and, using a number of elements, measured their absorption in aluminum. It is now known that when the voltage is increased to give the electrons from the cathode sufficient energy to remove an electron from an orbit in, say, the M-shell of the target atom, all the M-lines of the characteristic target spectrum will be emitted in addition to the continuous spectrum. On further increasing the voltage the intensities of the M-lines increase, and at a certain higher voltage groups of lines of the L-series will appear. At a still

Fig. 2. Upper dark curve: Spectrum from copper-target X-ray tube operated at 40 kilovolts peak (full-wave rectification), 0.012-mm thick mica and 0.12-mm thick beryllium X-ray tube window, measured on diffractometer with silicon crystal analyzer and scintillation counter. Dashed curve: 0.014-mm thick nickel filter inserted in X-ray path nearly eliminates  $\text{CuK}\beta$  line and causes a 45 percent reduction in  $\text{CuK}\alpha$ . Dotted curve: Obtained with filter and pulse-height analyzer set to transmit 90 percent of  $\text{CuK}\alpha$  (transmitted by filter); most of short-wavelength continuum is eliminated. The  $\text{WL}\alpha$ ,  $\beta$ , and  $\gamma$  lines arise from small amount of tungsten impurity on copper target. The I, Mo, Cu, and NiK-absorption edges originate in the scintillation crystal, slits, target, and filter, respectively.

W. Parrish, "Instruments and Measurements," Academic Press, N.Y., 1960



higher voltage the K-series will appear. For example, the minimum voltages  $V_0$  (in kv) required to produce the M-, L-, and K-series of platinum, and the wavelengths, of the most intense line in each series (called alpha one,  $\alpha_1$ ) are as follows:

Line	$V_0$	$\lambda$
PtMa <sub>1</sub>	2.8	6.023
PtLa <sub>1</sub>	13.9	1.310
PtKa <sub>1</sub>	78.4	0.185

The absorption coefficient (which is a measure of the penetrating power of the radiation) is shown as a function of wavelength in Fig. 3. (This property is discussed in section 2. *X-Ray Spectrochemical Analysis—X-Ray Absorptiometry.*)

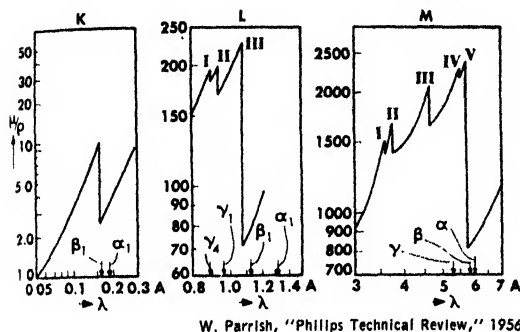


Fig. 3. Mass absorption coefficient ( $\mu/p$ ) of platinum shown as a function of wavelength in the regions of the K-, L-, and M-absorption edges. Some characteristic emission lines of the K-, L-, and M-series are indicated by arrows.

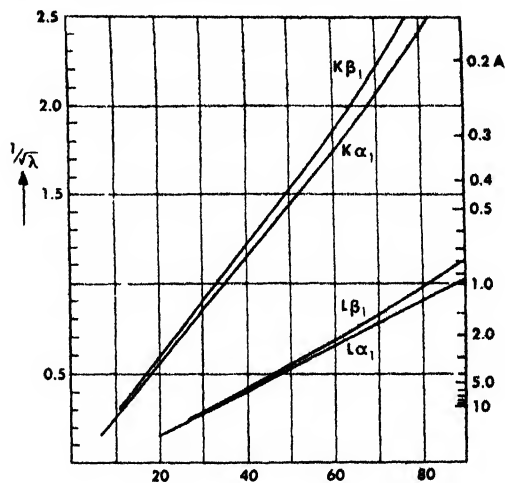
The voltages required to produce the characteristic lines of each series increase with the atomic number of the element. Thus, to begin to produce the K-series of aluminum only 1.6 kv must be applied to the X-ray tube, while production of the uranium K-series requires a minimum voltage of 117 kv. The intensity,  $I$ , increases rapidly as the applied voltage,  $V$ , is increased above  $V_0$  according to the relation

$$I = k(V - V_0)^n, \quad (2)$$

where  $k$  is a constant and  $n$  is 1.5 to 2. If a constant voltage is applied to the X-ray tube, the intensities remain constant (assuming the tube current is also held constant), but if the voltage is pulsating, that is, half- or full-wave rectified, the characteristic X-rays are produced only during those portions of the time cycle when  $V$  exceeds  $V_0$ . Consequently, the need to use constant potential to achieve high intensities increases with  $V_0$  (or with decreasing wavelength). Similarly, the continuous X-ray spectrum shifts back and forth during each half cycle and attains its extreme short-wavelength position only during the peak of the operating voltage, whereas with constant potential all wavelengths and intensities corresponding to the voltage are continually produced. Increasing the current of the X-ray tube increases the intensities of all the wavelengths in a linear manner and does not change the wavelengths.

In 1913, Moseley measured the characteristic

X-ray line spectra of a number of elements and found that the square root of the frequency of the various lines and the atomic number of the emitting element exhibit a nearly linear relationship, as shown in Fig. 4. This fundamental law, which is the basis of X-ray spectroscopy and which, as explained earlier, also played an important role in the early conception of atomic structure and the acceptance of Bohr's model of the atom, shows that each element has a characteristic X-ray line spectrum and that the wavelengths vary in a regular predictable fashion from one element to another. The wavelengths decrease as the atomic numbers of the elements increase.



W. Parrish, "Philips Technical Review," 1956

Fig. 4. Wavelengths of four characteristic X-ray spectral lines of elements plotted against atomic number,  $Z$ . Moseley's law specifies a linear relationship between  $1/\sqrt{\lambda}$  and  $Z$ .

The K-lines consist of a doublet,  $K\alpha_1$  and  $K\alpha_2$ , having nearly the same wavelengths and a  $K\beta$  line, which consists of three lines, usually unresolved, of shorter wavelengths. In the case of a copper target the wavelengths in Å and relative intensities are:

Line	Wavelength	Relative intensity
CuK $\beta$	1.39217	25
CuK $\alpha_1$	1.54051	100
CuK $\alpha_2$	1.54433	50

The wavelengths in Å of some of the characteristic lines of six elements follow:

Element	Atomic number	K $\beta_1$	K $\alpha_1$	L $\beta_1$	L $\alpha_1$
Al	13	7.981	8.338		
Cr	24	2.085	2.290	21.32	21.71
Zn	30	1.296	1.435	12.01	12.28
Zr	40	0.701	0.786	5.84	6.07
Nd	60	0.294	0.332	2.166	2.370
U	92	0.111	0.126	0.720	0.911

**Monochromatic X-Ray Beams.**—The simplest method of obtaining monochromatic X-rays is to use a filter whose K-absorption edge lies between the  $K\alpha$  and  $K\beta$  lines; for example, the use of a nickel foil 0.014 mm thick inserted in the X-ray

beam from a copper target reduces the  $K\beta$  line to 1 percent of its original intensity and also causes a reduction in the continuous spectrum, but reduces the  $K\alpha$ -line intensity by only 45 percent (see dashed curve in Fig. 2). The K-absorption edge lies at a slightly shorter wavelength than the  $K\beta$  line, and is the wavelength at which there is a large change in X-ray absorption. In the immediate vicinity of this wavelength, the X-ray absorption is much higher at the shorter than at the longer wavelengths. The wavelength at which the edge occurs increases with decreasing atomic number in the same manner as the characteristic lines. There are also L- and M-absorption edges, as shown in Fig. 3.

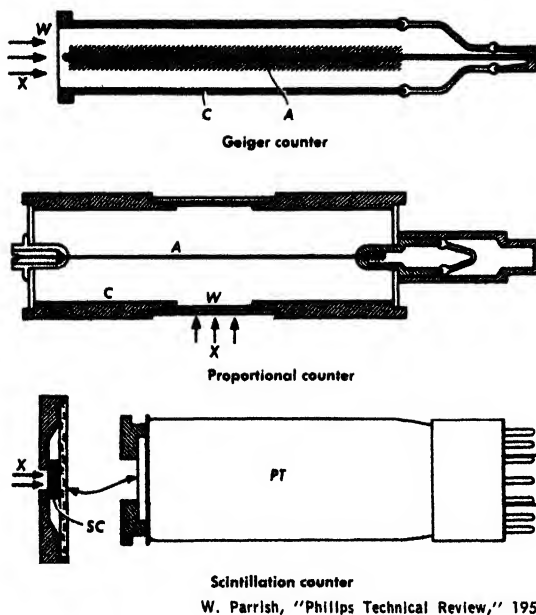


Fig. 5. Three common types of counter tube used for quantitative measurement of soft (low-energy) X-rays. X indicates incident X-ray beam, W is a thin, low-absorbing window, A the wire anode, C the cylindrical metal cathode, SC a scintillation crystal, and PT a photo-multiplier tube. Geiger counter is about 10 cm long and filled with argon to about 35 cm (Hg) pressure. Proportional counter is about 2 cm in diameter and filled with xenon to 30 cm (Hg) pressure. X-ray beam is absorbed in the gas or in scintillation crystal.

Another method of monochromatization is to use a proportional or scintillation counter (Fig. 5) together with a single-channel pulse-height analyzer. The average amplitudes of the pulses in these detectors are proportional to the energies of the X-ray quanta producing them. By setting the lower (base) level of the analyzer to reject all pulses below a selected amplitude, and the upper (window) level to reject all pulses above the selected amplitude, the system can be made to transmit only those pulses whose amplitudes lie within a selected range of X-ray energies. However, as a consequence of statistical processes involved in the production of these pulses, not all pulses produced by a single X-ray energy have exactly the same amplitude. There is instead a small spread of pulse amplitudes for each X-ray wavelength. Although perfect monochromatization thus is not possible by this electronic method, the degree of monochromatization achieved when the beta filter and pulse-amplitude discrimination

are used together (see dotted curve in Fig. 2) is sufficient for most applications. The pulse-height analyzer causes only about a 10 percent reduction of the  $CuK\alpha$  intensity transmitted by the nickel filter, but the continuous radiation is almost entirely eliminated.

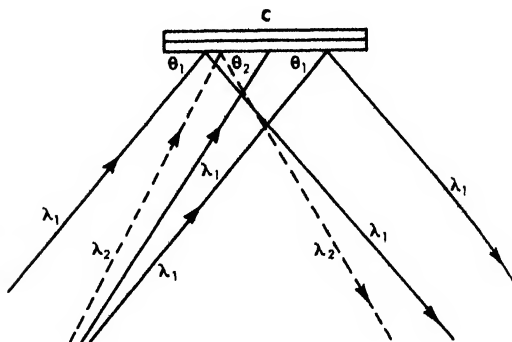
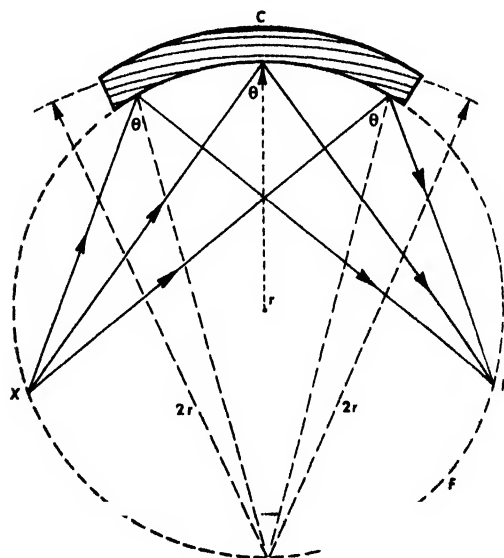


Fig. 6. Conditions for X-ray diffraction. X-rays of wavelength  $\lambda_1$  are diffracted by crystal C only at angle  $\theta$ . Central ray of wavelength  $\lambda_1$  is not diffracted because angle of incidence is different from  $\theta_1$ . Rays of a different wavelength  $\lambda_2$  are diffracted at a different angle  $\theta_2$ .

When X-rays are diffracted (see section J. *Physics of X-Rays—Bragg's Law*) from a nearly perfect single crystal, only a very narrow band of wavelengths appears in a given direction. This is shown schematically in Fig. 6, in which parallel



Johannson crystal monochromator. A parallel beam of monochromatic X-rays originating at X is diffracted by monochromator C so that all rays converge at R. Rays must strike crystal atomic planes bent to radius  $2r$  at angle  $\theta$ . Crystal surface is ground to radius  $r$  to match focusing circle F.

rays of one wavelength  $\lambda_1$  are diffracted at the same angle  $\theta_1$ . Inclined rays of the same wavelength do not make the correct angle and cannot be diffracted by the crystal. Rays of another wavelength  $\lambda_2$  will be diffracted at another angle

6. The X-ray reflection coefficients of the best crystals are less than about 10 percent and hence there is a large loss of intensity. T. Johansson devised a monochromator that utilizes a crystal surface ground to a radius  $r$  and bent to a radius  $2r$ , as shown in Fig. 7. If the X-ray source is very small the divergent beam of monochromatic X-rays will be focused perfectly at  $R$ , thereby permitting a large angular aperture and hence a corresponding increase of intensity over the flat-crystal monochromator.

Monochromatic X-rays may also be obtained by X-ray fluorescence, as described later, and from radioactive sources, as for example  $\text{Fe}^{55}$  decaying by K-capture to  $\text{Mn}^{55}$  and generating  $\text{MnK}$  X-rays in the process. The intensities in both these methods are much lower than those obtained by direct electron excitation in X-ray tubes.

**Bragg's Law.**—The atoms in crystalline substances are arranged in a symmetrical, repeating, three-dimensional pattern, and the distances between planes of atoms are of the magnitude of X-ray wavelengths. Hence, crystals act as three-dimensional gratings for X-rays in a manner analogous to the diffraction of ultraviolet or visible light by a ruled one-dimensional grating (see DIFFRACTION OF LIGHT). Under appropriate conditions the electrons associated with each atom will scatter an incident X-ray beam in a coherent manner, so that in certain specific directions the scattering from millions of atoms will be in phase at the same time.

It was shortly after von Laue's 1912 discovery of X-ray diffraction by crystals that this complex phenomenon was formulated in a simple geometrical relation by the Braggs. They showed that X-ray diffraction could be visualized as a reflection from a large number of parallel atomic planes according to the equation

$$n\lambda = 2d \sin \theta, \quad (3)$$

where  $n$  is a small integer giving the order of reflection analogous to the ruled grating,  $\lambda$  the wavelength of incident X-rays,  $d$  the distance between planes of atoms, and  $\theta$  the angle between the incident X-ray beam and the atomic planes

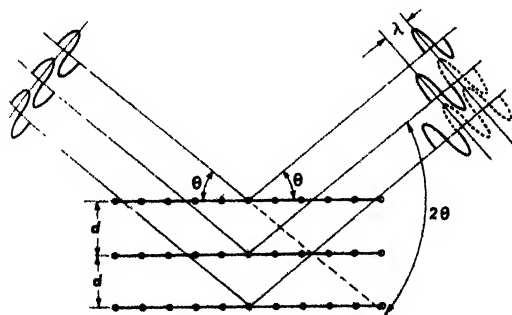


Fig. 8. Conditions for reflection of X-rays from successive lattice planes, as required by Bragg's law.  $\theta$ , glancing angle;  $2\theta$ , reflection angle;  $\lambda$ , wavelength;  $d$ , interplanar spacing.

(see Fig. 8). There is only one  $\theta$  angle at which the reflected rays are in phase for a given value of  $d$  and  $\lambda$ . At other angular positions of the crystal there is destructive interference and no reflections occur, as was indicated in Fig. 6. Thus the conditions for obtaining an X-ray reflection are very

restrictive, a reflection occurring only when X-rays of the same wavelength strike a crystal at the same glancing angle  $\theta$  to a set of equally spaced atomic planes and when the path difference of the rays from adjacent planes is an integral number of wavelengths. (This reflection phenomenon should not be confused with the nearly total reflection of X-rays that occurs at very small glancing angles from highly polished surfaces.)

Consider, for example, the case of reflection of  $\text{CuK}\alpha$  X-rays,  $\lambda = 1.54 \text{ \AA}$ , from one set of atomic planes of a flat, single-crystal plate of quartz in which  $d = 3.34 \text{ \AA}$ . When this set of planes makes an angle of  $13.3^\circ$  ( $\theta$ ) with the incident X-rays, a reflection occurs at twice this angle,  $26.6^\circ$  ( $2\theta$ ), with respect to the incident beam. A second-order reflection,  $n = 2$ , occurs at  $2\theta = 54.9^\circ$ , but there are no reflections between these angles. If  $\text{CrK}\alpha$  X-rays ( $\lambda = 2.29 \text{ \AA}$ ) had been used, the first-order reflection would have occurred at  $40.0^\circ$  ( $2\theta$ ) and the second-order reflection at  $86.5^\circ$  ( $2\theta$ ). The relative intensities of the reflections depend upon the atomic scattering factors and the atomic structure of the crystal (see CRYSTALLOGRAPHY—4. Crystal Structure).

A simple application of Bragg's law proved of great value during World War II in the manufacture of millions of quartz oscillator plates for use in frequency control of military communications. These crystals had been made in small quantities, but the sudden unprecedented requirements made it necessary to develop mass-production methods. The desired crystals required precision-cut angles with respect to the crystallographic axes. After an approximate visual or optical orientation of the raw quartz crystal, a test slice was cut with a diamond-impregnated saw, its precise orientation measured with X-rays, and the sawing angle corrected accordingly. Special X-ray machines with counter-tube detectors were developed that permitted unskilled personnel to make accurate measurements of the reflection angle in about 15 seconds. This technique was the first use of X-rays as an integral part of a manufacturing process.

## 2. X-Ray Spectrochemical Analysis

It was explained above that each element can be induced to emit the X-ray line spectrum characteristic of that element. Two methods have been used for emission analysis: the specimen, consisting of one or more elements, may be bombarded with electrons, as in the case of an X-ray tube, or the specimen may be irradiated by X-rays of higher energies (that is, shorter wavelengths) than the absorption edges of the elements causing X-ray fluorescence. See this section—X-Ray Absorptiometry.

**X-Ray Spectrographs.**—The radiation emitted by the sample is analyzed with an X-ray spectrograph, which consists of the X-ray source, a system of slits, a single crystal, a counter-tube detector and its electronic circuits, and a goniometer, an instrument that indicates the angles precisely and automatically scans the spectrum. The elements are identified (qualitative analysis) from the angles at which the crystal reflects each wavelength in accordance with Bragg's law, equation (3). The concentrations are determined (quantitative analysis) from the relative intensities by use of suitable calibration curves. Two major types of spectrograph geometry have been employed: nonfocusing (flat crystal) and focusing (curved crystal). A photograph of a complete X-



ray fluorescence spectrograph is shown in Plate 1.

A schematic diagram of the arrangement used in a modern nonfocusing X-ray spectrograph is shown in Fig. 9. Radiation is emitted either directly from the X-ray tube or from the fluorescent specimen. X-rays traveling in a certain direction pass through the parallel-slit assembly (Soller slits), whose thin, equally spaced, highly absorbing metal foils collimate the X-rays and limit the breadth of the recorded reflection. The single-crystal plate, oriented to reflect from only a single

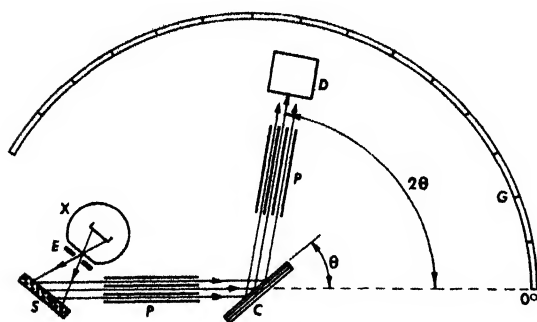
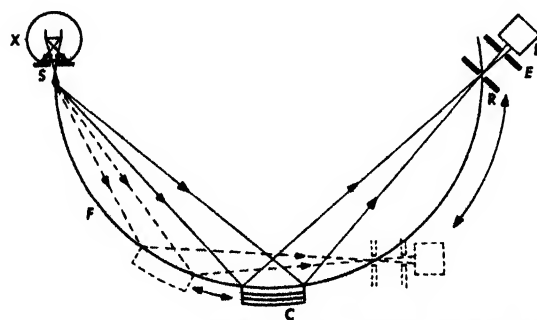


Fig. 9. Schematic drawing of nonfocusing X-ray spectrograph. X, X-ray tube; E, slits to reduce scattered radiation; S, large flat specimen; P, parallel Soller slits (one or two sets may be used); C, flat crystal; D, counter tube;  $\theta$ , Bragg angle;  $2\theta$ , reflection angle; G, goniometer scale.

set of planes with a known  $d$ -spacing, reflects one wavelength at a given angle in accordance with Bragg's law. By slowly rotating the crystal at one half the angular speed of the detector, the various wavelengths from the parallel beam of X-rays are reflected one by one as the crystal makes the proper  $\theta$ -angle for each wavelength. The intensity at each wavelength is then measured with a high-sensitivity scintillation counter or similar detector and automatically recorded.



W. Parrish, "Phillips Technical Review," 1956

Fig. 10. Schematic drawing of focusing X-ray spectrograph. Letters same as for Fig. 9 except F, focusing circle; S, small specimen; C, curved crystal; R, receiving slit. Soller slits, whose foils are parallel to plane of drawing, are not shown.

The focusing X-ray spectrograph, one type of which is shown in Fig. 10, is required for very small specimens. The specimen surface, the surface of the curved crystal (prepared as shown in Fig. 7), and the receiving slit are situated on the

focusing circle. To measure different wavelengths the crystal is moved around the focusing circle at one half the angular speed of the receiving slit and detector, as shown by the dotted lines. At the same time the detector is swiveled to always point at the center of the crystal.

Both the angle at which the various wavelengths are reflected and the angular separation (dispersion) of the wavelengths are dependent upon the  $d$ -spacing of the reflecting atomic planes of the crystal analyzer, as shown in Fig. 11. (The

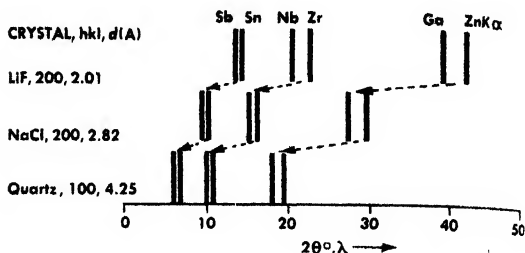


Fig. 11. Effect of crystal-analyzer lattice spacing  $d$  on positions of  $K\alpha$  lines of several elements (schematic)

numbers  $hkl$  used in Fig. 11 are the Miller indices of the reflecting planes (see section 3. X-Ray Powder Diffraction—Determination of Miller Indices). Three common crystals are depicted as analyzing the  $K\alpha$  reflections of three sets of adjacent pairs of elements. When the value of  $d$  decreases the reflections occur at larger angles and have a greater separation, as can be seen by differentiating Bragg's equation:

$$\frac{\Delta\theta}{\Delta\lambda} = \frac{n}{2d \cos \theta} \quad (4)$$

It is thus easy to increase the dispersion simply by using a crystal with a smaller  $d$ . The crystal analyzer cannot reflect a wavelength larger than  $2d$ , and in practice the upper limit of wavelengths that can be measured is further restricted because the goniometer cannot scan beyond about  $150^\circ$  ( $2\theta$ ) due to mechanical restrictions.

The spectrograph may be eliminated in certain relatively simple cases involving routine analyses of a series of samples containing a small number of known elements within a fixed range of composition. The radiation to be analyzed enters directly into a proportional or scintillation counter, and the analysis is based on the fact that each wavelength produces a different known average pulse amplitude. Separate channels of a multi-channel pulse-height analyzer are used for each element in this nondispersive method. By eliminating the crystal, the intensity is greatly increased and all the elements may be determined simultaneously. However, the relatively poor energy (wavelength) resolution of the counter tubes causes overlapping pulse-amplitude distributions from nearby wavelengths and limits this method to the analysis of elements whose wavelengths are well separated from one another.

**X-Ray Emission Spectroscopy.**—The direct, or electron, excitation of X-ray spectra was the method first used by Moseley, Karl Manne Georg Siegbahn, and others to measure X-ray wavelengths. It was soon recognized that the method could be used for chemical analysis, and in fact

Moseley obtained the spectrum of a piece of brass that showed strong copper and somewhat weaker zinc lines, and this was the first X-ray chemical analysis. The element hafnium was discovered by Georg von Hevesy in 1922 from its X-ray spectrum. However, the method was not widely used because it obviously is limited to those specimens that can be made into the form of an X-ray tube target. The specimen must withstand the high-energy electron beam and the vacuum and it must not disintegrate from the heating in the X-ray tube. Steel and alloy samples have been analyzed in this manner. The sensitivity is high due to the high intensities.

In 1950, R. Castaing modified the method for microanalysis. He altered the electron-optics column of an electron microscope by adding a second electrostatic lens to obtain an electron beam about 1 micron ( $\mu$ ) in diameter. The specimen was mounted in the vacuum chamber on an accurately machined table that could be adjusted from the outside to bring the desired area of the specimen into the fine electron beam, the positioning being observed with an optical microscope. In this method the emitted X-rays are analyzed by a focusing X-ray spectrograph and counter tube. The X-ray tube current is about 1 microampere, which is much lower than in normal X-ray tubes, so that the problem of specimen heating is virtually eliminated. Nonmetallic specimens are usually first coated with a thin metallic layer to eliminate charging of the surface. By moving the specimen, point-by-point chemical analyses can be made. Although the instrumentation is quite complex, the method has found wide application in a variety of fields, particularly in metallurgical studies, and yields information on a microscale that cannot be obtained in any other way. It is claimed that for elements in the middle of the periodic table the ultimate detection limit is about  $10^{-11}$  gram.

**X-Ray Fluorescence Spectroscopy.**—The fluorescence method is by far the more common method of emission analysis because the specimen preparation is much simpler, the apparatus is less complex, and the calibration is easier to perform. The lines of the fluorescence spectrum have the same characteristic line wavelengths as the electron-excited lines, and the continuous spectrum is absent. The fluorescent lines observed in an X-ray spectrograph are approximately  $1/1000$  as intense as the direct-electron-excited lines, but with modern high power X-ray tubes and counter tubes having nearly 100 percent quantum counting efficiency the intensities are sufficiently high to allow their use for routine analysis, as was shown by Herbert Friedman in 1947. The electron beam is focused on a relatively large area of the target to allow the maximum power to be applied to the X-ray tube. The specimen must be placed very close to the window (on the outside of the X-ray tube) because the primary X-ray intensity diminishes as the square of the distance between the target and the specimen.

An element produces the strongest fluorescence when irradiated by primary X-rays of wavelengths slightly shorter than its absorption edge. Thus, the characteristic lines from a copper target,  $\text{CuK}\alpha$  and  $\text{CuK}\beta$ ,  $\lambda = 1.54 \text{ \AA}$  and  $1.39 \text{ \AA}$ , produce strong secondary X-rays in cobalt, whose absorption edge is at  $1.61 \text{ \AA}$ , but no fluorescence in zinc, whose edge is at  $1.28 \text{ \AA}$ .

Instead of using only the characteristic lines of the X-ray target material, which would excite

strong fluorescence in only a few elements, the continuous "white" radiation is also used to cause a whole series of elements to fluoresce. A tungsten-target X-ray tube operating at 50 kv or more produces a large amount of continuous radiation as well as the tungsten L-spectrum, and is often used for this purpose.

**Advantages Over Other Methods.**—In many cases the X-ray method is more rapid than the optical method and the calibrations required for quantitative analysis are usually simpler. The X-ray method is superior for analyses involving amounts from 1 to 100 percent, wherein an accuracy of about 1 percent of the amount present can be achieved; the procedure requires about one minute of actual measurement (not including the time for calibration and specimen preparation). In general the optical method is more sensitive for trace-element analyses. Good results have been reported for the X-ray method for concentrations as small as 0.1 to 0.001 percent, but the accuracy is lower and the time required is longer. If the specimen is subjected to some prior physical or chemical process to enhance the concentrations of the minor elements, the lower limits of detectability may be greatly extended. Thus, analyses have been performed in the range of 1 part per million (ppm) or less on small samples prepared by concentration of a large sample. Microgram and smaller quantities of elements have been analyzed quantitatively in this manner. The X-ray method is as accurate as a quantitative chemical analysis, requires far less time, and is nondestructive.

**Applications.**—The fluorescence method has been applied to a great variety of problems, of which only a few are mentioned here. The analyses of rare-earth ores are very difficult to do by conventional chemical methods because the rare-earth elements have similar properties, but the X-ray method has been successful in the quantitative analyses of a large number of rare-earth elements present in such ores. Other examples include the determination of nickel, chromium, and other elements in high-temperature steels and the measurement of lead and bromine in gasoline, sulphur in oil, uranium in aqueous solutions, and the hemoglobin in blood.

The fluorescence method has been used for all elements from sodium to uranium. There are three major analytical regions determined by the wavelengths and instrumentation, as shown below.

Wavelengths ( $\text{\AA}$ )	$V_0$ (kv)	Atomic numbers and elements	Series
0.1-0.5	117-25	92 U-46 Pd	K
0.5-2	24-7	45 Rh-26 Fe 92 U-65 Tb	K L
2-12	6.5-0.8	25 Mn-11 Na 64 Gd-31 Ga 92 U-62 Sm	K L M

The first group of elements has the shortest wavelengths and hence a crystal with a small  $d$  (of the order of  $1.5 \text{ \AA}$ ) is required. The elements of highest atomic number require the highest voltages to produce their K-lines, and since the apparatus is often limited to 50 or 60 kv the L-lines, which require much lower voltages, may be used. The second group covers the series of intermediate wavelengths most commonly used and requires the simplest instrumentation. The third group contains the long wavelengths beyond  $2 \text{ \AA}$ , which cause some experimental difficulties because they

are strongly absorbed in air. For example, about 90 percent of  $\text{TiK}\alpha$ ,  $\lambda = 2.75 \text{ \AA}$ , is absorbed in a spectrograph having an air path 13 inches long, and either a helium-gas path or a vacuum chamber must be used. In addition, the fluorescent intensities of the longer wavelengths are much lower because the fluorescence yield decreases with increasing wavelength. (The primary X-rays from the X-ray tube are less efficient in producing long-wavelength fluorescence, and the absorption in the specimen is greatly increased.) The crystal must have a large  $d$ , of the order of 4.5  $\text{\AA}$ . The  $\text{NaK}\alpha$  line ( $\lambda = 11.9 \text{ \AA}$ ) is about the longest wavelength that has been analyzed in routine measurements.

The specimens used for X-ray spectroscopy may be amorphous or crystalline powders, polished and etched metallographic specimens, or even liquids. There is a relationship between the fluorescent X-ray intensity as measured and the amount of element in the sample. The increase in intensity with concentration is seldom linear because of the absorption of the fluorescent X-rays by the specimen itself. Since the composition of the specimen may vary over wide ranges, the measured intensities show a marked dependence upon the absorption. Therefore, for accurate quantitative analysis, empirical calibration curves for each element of interest must be made with a small number of standard specimens of roughly the same composition.

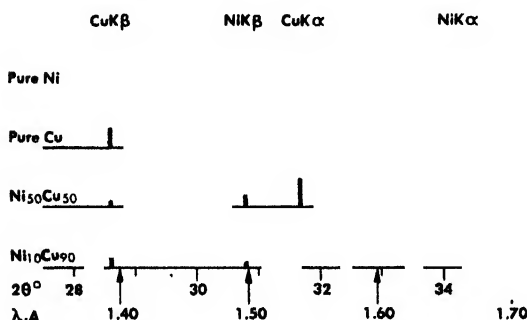


Fig. 12. X-ray spectrograms (schematic) of copper and nickel. (Sodium chloride crystal.)

A fluorescence analysis of nickel and copper taken with a sodium chloride crystal analyzer is shown in Fig. 12. The upper two charts show the simple K-spectra of pure nickel and pure copper. The third chart shows the spectrum of a mixture of equal parts of nickel and copper. In this technique, a solid solution and a mixture give the same spectrum, unlike X-ray diffraction, described below. The  $\text{CuK}\beta$  line is of relatively less intensity than in the case of pure copper because it is strongly absorbed by the nickel. The bottom chart, which shows the spectrum for a mixture of 10 percent nickel and 90 percent copper, reveals how the relative intensities are dependent upon the concentration of the elements in the specimen.

**Use of Automation.**—The X-ray fluorescence method is adaptable to a considerable degree of automation. The crystal and detector can be programmed to step automatically to a number of preselected Bragg-angle positions and the intensities recorded for each element in sequence. A series of samples can also be automatically in-

troduced in the spectrograph. Alternatively, by using a number of crystals and detectors, each set for a specific wavelength, all the elements in the sample may be determined simultaneously. After such instruments have been calibrated, the operation is simple and analyses are performed rapidly. Rapid analyses are required in industrial production control; for example, in following the increases in concentrations of certain elements during mineral-dressing processes.

**X-Ray Absorptiometry.**—Although X-rays are very penetrating, they suffer absorption as they pass through matter. The amount of absorption depends upon the X-ray wavelengths (energy) of the incident beam and upon the elemental composition and thickness of the sample. If  $I_0$  and  $I$  are the intensities of the incident and transmitted beam,  $\mu/\rho$  the mass absorption coefficient of the material (which is independent of the physical state of the material),  $\rho$  the density, and  $t$  the thickness, then

$$I = I_0 e^{-\frac{\mu}{\rho} \rho t} = I_0 e^{-\mu t} \quad (5)$$

If the specimen consists of a number of elements, whether in solid solution or as a mixture, and if the elements are evenly distributed throughout the specimen, the mass absorption coefficient can be related to the weight percentages  $w$  of the individual elements  $A$  and  $B$  in the specimen by the equation

$$\left(\frac{\mu}{\rho}\right)_{\text{spec.}} = \frac{w_A}{100} \left(\frac{\mu}{\rho}\right)_A + \frac{w_B}{100} \left(\frac{\mu}{\rho}\right)_B + \quad (6)$$

The absorption coefficients increase with wavelength of the incident beam and with atomic number of the absorbing element. The X-ray absorption is approximately proportional to the third power of the X-ray wavelength and to the fourth power of the atomic number of the absorbing element. There are sharp discontinuities in the absorption versus wavelength curve at the absorption edges of the element, as shown in Fig. 3. There are three absorption edges,  $L_I$ ,  $L_{II}$ , and  $L_{III}$ , associated with the L-series of lines, and five edges associated with the M-lines, as shown.

If the incident beam is polychromatic, the absorption measurements will be difficult to interpret in terms of elemental composition. The use of monochromatic X-ray beams, although they are of much lower intensity than polychromatic beams, greatly simplifies the interpretation of the data. High sensitivity can be achieved by making several successive measurements using monochromatic beams having wavelengths on both sides of the absorption edge of the absorbing element. The sensitivity of the method depends on the change in absorption across the absorption edge. This change increases with decreasing atomic number, but since the low-atomic-number elements have their absorption edges at long wavelengths the technical difficulties increase. The method has been used to determine sulphur in hydrocarbons; uranium, thorium, and molybdenum in solutions; and for similar problems.

One of the important industrial applications in which the absorption of X-rays is used as a method of control is noncontact thickness gauging. An X-ray tube (or sometimes a radioactive

isotope) is mounted on one side of the continuously moving strip of homogeneous material that is to be gauged. The radiation that penetrates the material and reaches the detector on the other side is dependent on the absorption of the material and hence is inversely proportional to the thickness in the irradiated area. Automatic control may be arranged by having the detector signal correct the controls on the processes that determine the thickness, or reject pieces that are beyond the preselected tolerances. The method has been applied to the gauging of metal, rubber, and plastic thickness, the measurement of the density of cigarettes, and similar processes. (See also GAMMA RAY.)

Another application based on the absorption of fluorescent X-rays has been in the measurement of the thickness of thin tin plating on steel. The iron in the steel is irradiated to produce fluorescence, and the reduction of this fluorescent intensity as the X-rays pass through the tin plate provides a measure of the thickness of the plate.

### 3. X-Ray Powder Diffraction

It was shown previously that X-ray reflection from a single crystal occurs only under certain conditions satisfying Bragg's law. (For a discussion of single-crystal diffraction, see CRYSTALLOGRAPHY—4. *Crystal Structure*.) However, if the crystal is crushed to form a fine-grained powder, there will be many crystallites with the correct  $\theta$  orientation for each of the  $d$ -spacings. The specimen also may be in the form of a solid polycrystalline aggregate or foil. This so-called powder method, the most widely used of all X-ray analytical techniques, was developed independently by Peter Joseph Wilhelm Debye and Paul Scherrer and by Albert Wallace Hull in 1917.

**Scope of Method.**—X-ray powder-diffraction studies are used in a great variety of applications. These include analysis and control of raw and finished products as well as research in the fields of ceramics, metallurgy, chemistry, mineralogy, biology, pharmacy, engineering, and electronics. Paint pigments, petroleum products, engine deposits, soils, metals and alloys, pharmaceuticals, catalysts, clays, boiler deposits, minerals, and soaps are but a few of the materials analyzed with X-rays. The powder method was used to determine the chemistry of the transuranic elements and their compounds. Many of these substances are highly radioactive with a short half-life, so that speed and safety were essential. These facts, and the small amounts of samples available, made chemical methods very difficult to apply. Several laboratories use X-rays for the routine analysis of quartz in industrial dusts. A procedure for the quantitative analysis of the minerals in bauxite exploration-samples has been developed in which the X-ray analysis gives results within 1 to 2 percent of chemical analysis in about 10 man-minutes, thus permitting an enormous saving of time. The X-ray analysis is made on the substance in its original solid form and is nondestructive with respect to the sample, whereas in chemical or optical spectrographic analysis the substance is dissolved, vaporized, or altered in some manner to determine the constituent elements.

An X-ray diffraction analysis of a mixture of the ore minerals chalcocopyrite ( $\text{Cu}_2\text{FeS}_3$ ), bornite ( $\text{Cu}_5\text{FeS}_4$ ), and pyrite ( $\text{FeS}_2$ ) would

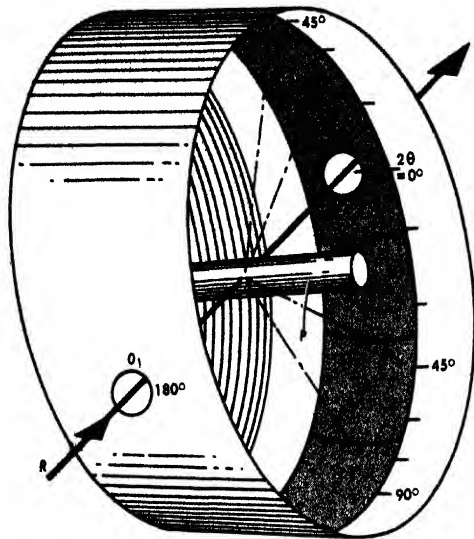
identify each of the three minerals, and their relative amounts could be determined. A chemical analysis would give the weight percent of copper, iron, and sulphur, but could not explain how these elements had been chemically combined; hence the minerals could not be identified. Such a limitation is also encountered in X-ray spectroscopy. To cite another example, the chemical analysis of a quartz sand used for making glass might show, in addition to silicon dioxide, impurities of a few percent of iron and titanium. In order to determine the best method of purification, it is necessary to know whether the impurities are present as a thin coating on the quartz grains or as separate admixed crystals of rutile, ilmenite, magnetite, or some other mineral. Microscopic examination combined with X-ray analysis will reveal how these impurities are present and their relative amounts, whereas chemical analysis would show only the bulk composition.

X-rays often afford the only practical means of following the course of a chemical reaction. For example, if an alloy of copper and nickel is desired, the required amounts of each element will be weighed, mixed, and heated. If the heat is insufficient for the elements to alloy, the X-ray pattern will be a mixture of the two patterns, as shown at the bottom of Fig. 18. Heating at a temperature sufficient to allow a complete reaction will give the X-ray pattern depicting a solid solution. No other method has proved as useful in following complicated reactions. For example, in the manufacture of ceramic magnetic materials, various substances such as the oxides of iron, zinc, and manganese are mixed together in their proper proportions and fired. A reaction occurs, forming a useful magnetic spinel phase having a totally different structure than the original individual oxides. If some of the oxides remain unreacted, the properties of the magnetic material will be altered. X-rays are used to study the course of the reactions and to work out the proper firing conditions. Chemical analyses are of little aid in such reaction studies because the end product has the same chemical composition as the original materials.

**Powder Camera.**—There are several methods of obtaining powder patterns. The simplest is to use a powder camera (see Fig. 13), which consists of a lighttight cylindrical chamber in which the film is mounted, holes for introducing a collimator tube, and a tube to conduct the undiffracted beam out of the camera without blackening the film. A small amount of powder is glued onto a thin (0.1-mm to 0.2-mm diameter), low-absorbing glass fiber that is mounted in the center of the camera and rotated continuously in the X-ray beam.

The probability of having crystallites in all possible orientations is large, provided the crystallites are of the order of 1 to 10  $\mu$  in size, and consequently all possible reflections from the various sets of atomic planes can occur simultaneously. Each crystallite may produce a reflection that will appear as a spot on the processed film. For any given value of  $d$  there will be a large number of crystallites in various orientations, each producing its own spot. The reflected rays will form the surface of a cone having its apex at the specimen and subtending the angle  $4\theta$ . Each set of atomic planes produces a separate concentric cone, and these

cones appear on the film as a series of arcs whose curvature depends on the particular reflection angle, as shown in Plate 2. The  $d$ -spacings are determined by measuring the linear distances on the film from the direct beam to each of the arc lines, converting these quantities into angular values ( $2\theta$ ), and substituting in the Bragg equation, the wavelength of the characteristic radiation being known.



W. Parrish, "Philips Technical Review," 1948

Fig. 13. Principle of powder camera. R, incident X-ray beam; P, cylindrical powder specimen; F, film; O<sub>1</sub> and O<sub>2</sub>, apertures.

The powder specimen scatters the continuous as well as the characteristic radiation, thereby adding to the background. André Guinier showed that when X-rays are first reflected from a curved crystal oriented for, say, the  $K\alpha$  line, a thin flat specimen may be used in transmission to obtain the powder pattern, as shown in Fig. 14. The resulting powder pattern has a lower line intensity, but the background is greatly reduced compared with the previous camera described, so that it is easier to observe weak lines.

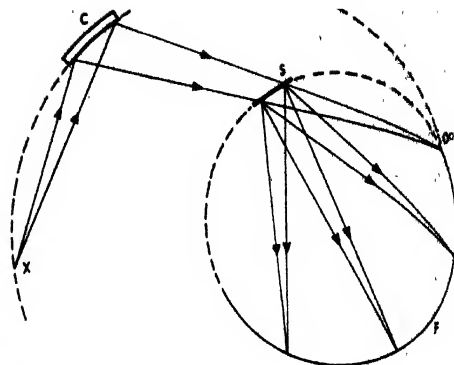
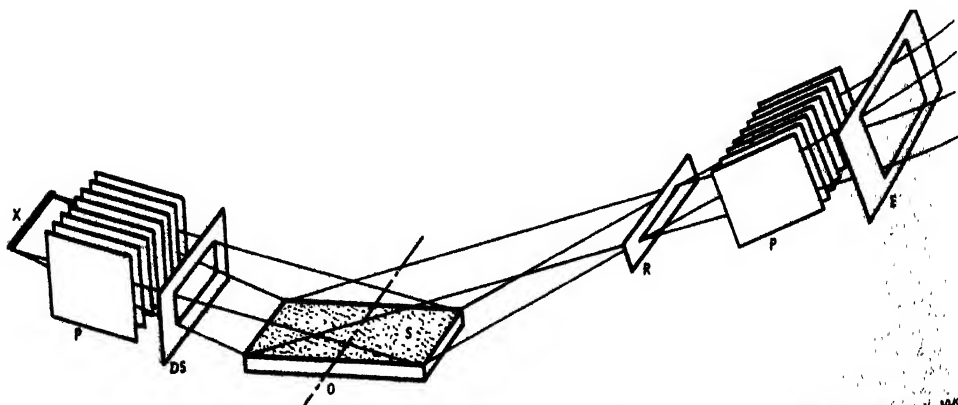


Fig. 14. Principle of Guinier focusing monochromator powder camera. Divergent X-ray beam originating at X is first reflected from focusing crystal C and then passes through flat specimen S. Focused diffraction lines are detected on film F.

**X-Ray Diffractometer.**—The X-ray diffractometer uses a highly sensitive soft X-ray detector in place of the film to record powder patterns automatically with greater resolution and precision than is possible by film methods. The system generally used was developed by William Parrish in 1947, and is shown schematically in Fig. 15. The specimen is prepared in the form of a flat or curved surface about 10 by 20 mm in area. The divergent primary beam of X-rays converges after reflection from the specimen, passes through a narrow slit, and enters the detector. The detector is driven at twice the speed of the specimen so that the specimen surface is always at  $\theta$  when the detector is at  $2\theta$ . Parallel slits are used normal to the focusing plane to obtain sharp lines. The goniometer drives the detector and specimen at predetermined constant speeds, and the pattern may be recorded using a count-rate meter and strip chart as the scanning proceeds. The resulting chart shows the intensities as a function of reflection angles  $2\theta$  (see Plate 2). The pulse-amplitude discrimination method described earlier is used, so that the recorded background is low. To achieve the lowest possible background.

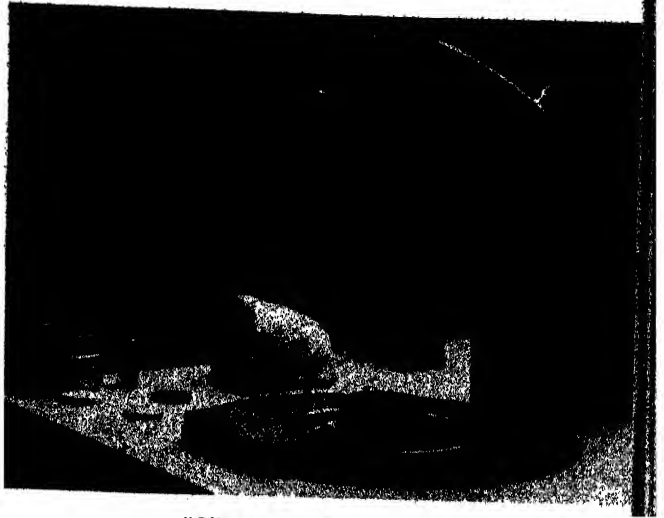
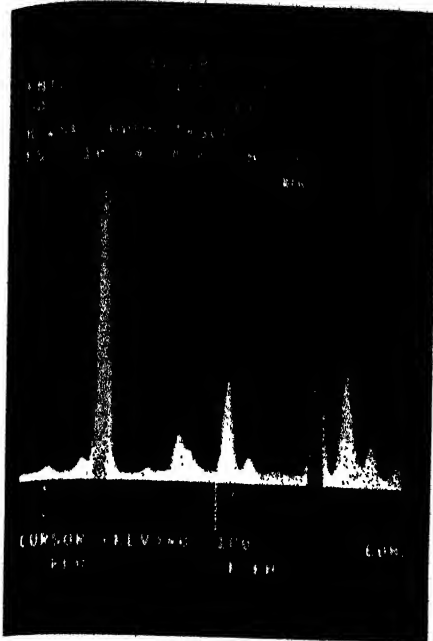


W. Parrish, "Science," 1949

Fig. 15. Principle of diffractometer. Divergent beam of X-rays from narrow line source X passes through divergence slit DS to large flat or curved specimen S. Diffracted beam converges at receiving slit R and continues to counter tube placed beyond anticatter slit E. Parallel slits P limit beam divergence in planes normal to axis of rotation  $\theta$  of specimen, and are normal to orientation used in X-ray spectrograph of Fig. 9. Distances X to O and O to R must be equal.



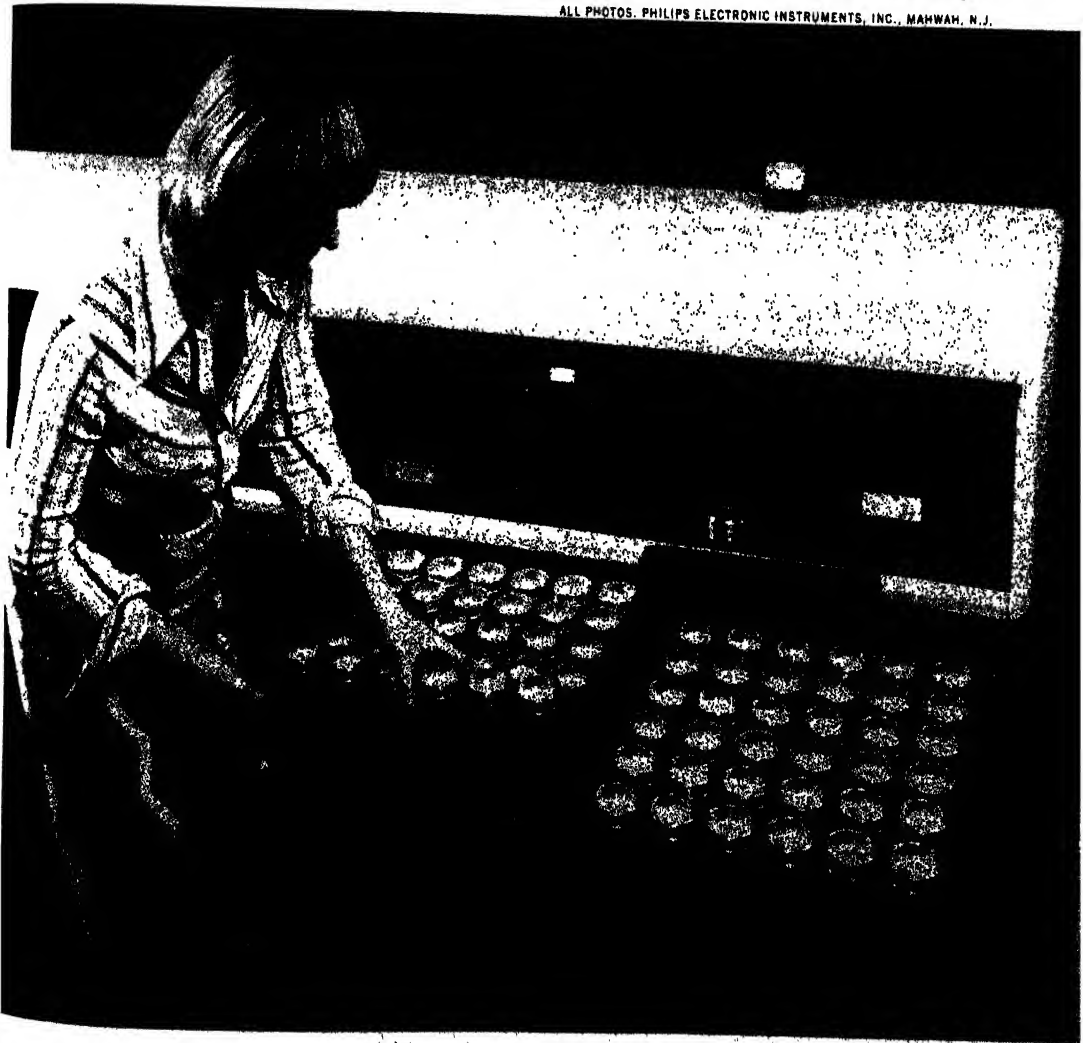
# X-RAYS

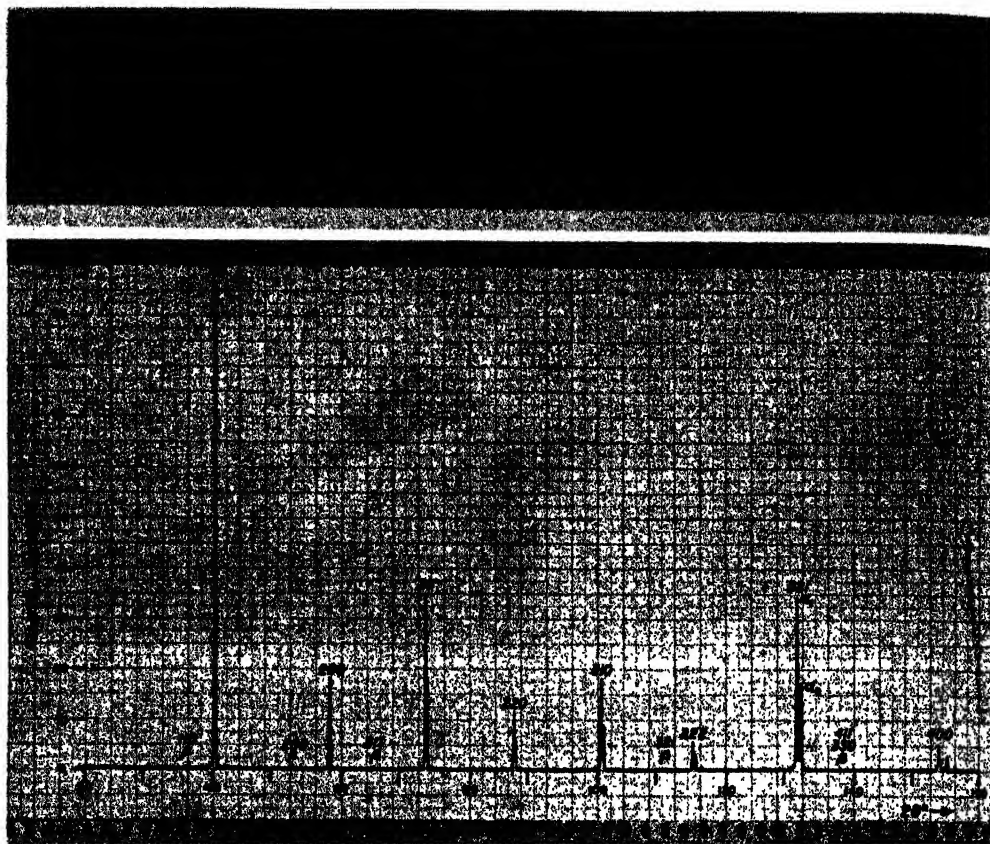


## X-RAY SPECTROSCOPY

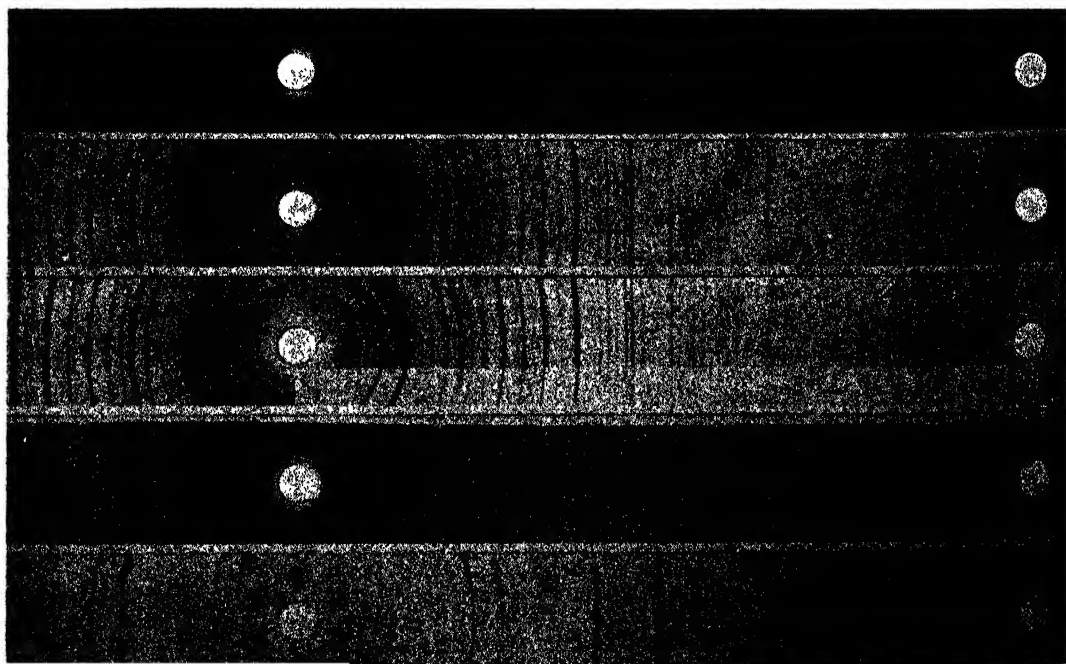
(Above), The top of an X-ray spectrometer ready for loading; it can analyze powder, solid, or liquid samples. (Left), A video display shows the analysis of a sample of glass. The spectrum displayed reveals five elements: Na, Al, Si, K, and Ba. (Below), An X-ray spectrometer equipped with automatic sample changer.

ALL PHOTOS. PHILIPS ELECTRONIC INSTRUMENTS, INC., MAHWAH, N.J.





Powder-camera film (upper) and diffractometer recording (lower) of tungsten powder pattern obtained with nickel-filtered copper X-rays. Miller indices are shown for each reflection. Exposure time for film and recording time for chart were both  $2\frac{1}{4}$  hours.



X-ray powder photographs obtained with copper-target X-ray tube. Top to bottom: aluminum, unfiltered; quartz with nickel filter on X-ray tube window; quartz with nickel filter strip on bottom of film; lead nitrate; brass wire, showing typical drawn-wire texture (uneven intensities on rings and symmetrical spots around  $0^\circ$  hole).

the diffractometer may also be used with a transmission specimen followed by a curved-crystal monochromator. It is evident that precise measurements may be made much more easily with counter tubes than with film, particularly with manual settings on any of the sections of the pattern that are of particular interest. Quantitative measurements thus become possible.

**Determination of Miller Indices.**—The atoms or molecules in a crystalline substance are arranged in a symmetrical three-dimensional pattern in which an atom or a group of atoms is repeated by the symmetry of the crystal along straight lines throughout the crystal. This is shown schematically in Fig. 16, in which the array of points and light lines outline a rectangular two-dimensional lattice or framework of one type of ideal crystal. In a real crystal there would be many other sets of planes, including planes parallel to the paper. The smallest group of atoms having the symmetry of the entire lattice pattern is called the unit cell, which in this case has edges parallel to and lengths equal to  $a$  and  $b$ .

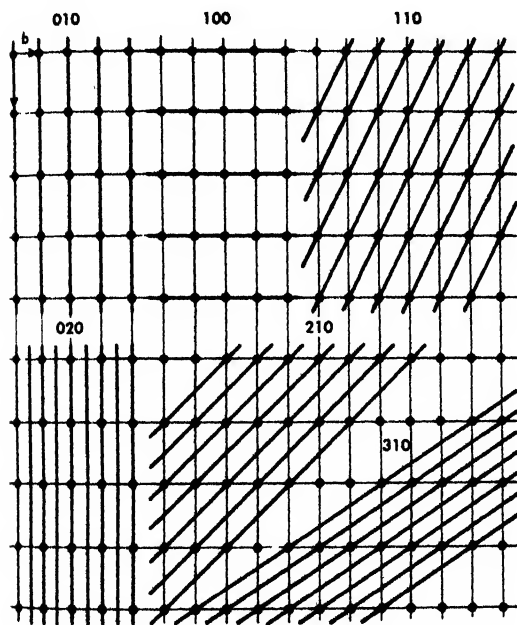


Fig. 16. Two-dimensional lattice, showing Miller indices of several sets of parallel planes. The  $c$ -axis is normal to

The traces of the various atomic planes normal to the paper are indicated by the heavy lines. Crystallographers identify these planes in a simple manner. For a given set of planes the number of lines crossed from one lattice point to the next along  $a$  are counted, and the procedure is repeated along  $b$  (and  $c$ ). The resulting small whole numbers, designated  $h$ ,  $k$ ,  $l$ , are known as the Miller indices of that set of planes. Thus the Miller indices of the lines in the lower right-hand corner are (31), and if they represent planes normal to the paper and thus do not intersect  $c$ , the Miller indices are (310).

The spacings,  $d$ , between the planes are related to the Miller indices and the edge lengths of the unit cell. For crystals of the cubic sys-

tem, the three crystallographic axes are normal to each other, have the same length, and

$$d = a / (h^2 + k^2 + l^2)^{1/2} \quad (7)$$

The assignment of Miller indices to each of the reflections in the X-ray pattern is called indexing the pattern and is often an important procedure. This is illustrated for the tungsten powder pattern shown in Plate 2. In this case  $\text{CuK}\alpha$  radiation,  $\lambda = 1.542 \text{ \AA}$ , was used and the first reflection observed at  $40.30^\circ$  ( $2\theta$ ). From Bragg's equation  $d = 2.238 \text{ \AA}$ , assuming  $n = 1$ . It was known that  $a$  was approximately  $3.165 \text{ \AA}$  and from equation 7,  $(h^2 + k^2 + l^2)^{1/2} = 1.4$ . Two of the three Miller indices must be one, and the third zero. (It cannot be determined from the powder pattern whether the indices are 110, 101, or 011). To check if  $a$  is correct, a high-angle reflection, 400 observed at  $153.59^\circ$  ( $2\theta$ ,  $\text{CuK}\alpha$ ), may be used. From Bragg's equation,  $d = 0.7911 \text{ \AA}$  and from equation 7,  $a = 3.1644 \text{ \AA}$ .

Relations similar to equation 7 exist for the other five crystal systems. Various types of tables and charts are available to facilitate the indexing procedure. The complexity (that is, the number of reflections) of powder patterns increases rapidly with decreasing crystal symmetry and increasing unit cell size, and hence the indexing of patterns of substances belonging to the tetragonal, hexagonal, and orthorhombic systems becomes more difficult; however, it can usually be accomplished. Patterns for substances belonging to the monoclinic and triclinic systems are very difficult to index and often require elaborate computer programs; in these cases data from single crystals also are usually required to supplement the information from the powder pattern.

**Identification of Crystalline Solids.**—One of the most useful and important applications of the X-ray powder-diffraction method is in the identification of solid crystalline substances. The basis of the method is the fact that each substance gives a characteristic X-ray pattern, and no two chemically distinct substances give identical patterns. The positions of the lines and their relative intensities do not vary for a given set of experimental conditions. Hence, if the unknown substance gives the same X-ray pattern as a known substance, the identification is complete. The powder pattern establishes the identity of a substance with the same certainty that fingerprints identify a person. The method is rapid and inexpensive (aside from the initial cost of the equipment), and it requires only a small amount of the sample. The pattern results from the crystal structure (arrangement of the atoms) rather than from the constituent elements of the substance, and if the specimen contains a mixture of several crystalline substances, each produces its own characteristic pattern.

Identification of unknown substances is made by comparing the pattern of the unknown sample with that of a known substance. A file of reference substances is necessary. For this purpose the American Society for Testing Materials, Philadelphia, Pa., publishes a catalogue of X-ray data obtained from the literature. The file now contains data on many thousands of substances, including minerals, metals and alloys, and inorganic and organic compounds, and is continually being expanded. To facilitate identification, the data cards are arranged according to the  $d$ -spacings of the three most intense lines of the pattern.

Substances with the same crystal structures give similar X-ray patterns, with small changes in the spacings and intensities of the lines. The similarities are usually clear enough to be revealed by visual comparison of the patterns. Such information is useful in relating substances that have markedly different chemical compositions. Fig. 17 shows the X-ray patterns of diamond (car-

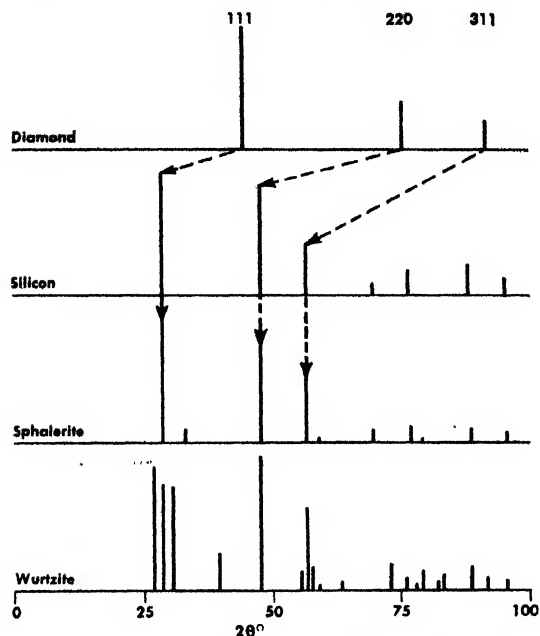
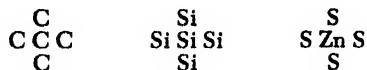


Fig. 17. Powder patterns (schematic) of isostructural and polymorphic substances.

bon), silicon, sphalerite, and wurtzite.<sup>1</sup> Every atom in each of the first three substances is surrounded by four other atoms, and their structures may be represented as follows:



Many other basic structure types have been revealed by X-ray analysis.

Some substances of the same chemical composition may occur in two or more different atomic arrangements called polymorphic forms (see CHEMICAL CRYSTALLOGRAPHY). Since the atomic arrangement is different, the X-ray patterns will be different even though the chemical composition is the same. This is shown by comparing the patterns of sphalerite (the cubic form of ZnS) with those of wurtzite (the hexagonal form) given in Fig. 17. There are many well-known cases of polymorphism; for instance, diamond and graphite, both carbon, and glass and quartz, both silicon dioxide. Different heat treatments or slight changes in chemical constitution may cause different forms to occur, the physical properties of which may be quite different. X-rays are extremely useful in distinguishing between these forms.

<sup>1</sup> Figs. 17 and 18 are schematic drawings. The positions of the lines are those obtained with CuK $\alpha$  X-rays, and the relative intensities are indicated by the heights of the lines.

**Solid Solutions and Mixtures.**—In addition to the gross features discussed above, small changes may occur in the X-ray pattern that reveal important facts useful for the analysis of matter in the solid state. Consider the simple X-ray patterns of the metals nickel and copper (Fig. 18). Since

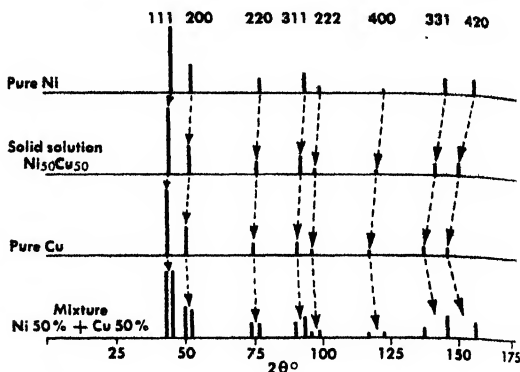


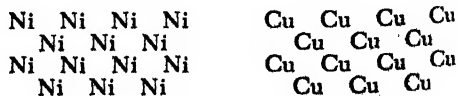
Fig. 18. Powder patterns (schematic) illustrating differences between pure substances, a solid solution, and a mixture.

both have the same structure, they give similar X-ray patterns that differ only in the spacings of the lines. The radius of the nickel atom is somewhat smaller than that of the copper atom (1.25 Å and 1.28 Å, respectively). The atomic planes of nickel are closer together and thus the  $d$ -spacings are smaller. The X-ray patterns show the nickel lines occurring at larger  $2\theta$  angles, which correspond to smaller  $d$  values. Note that the lines occurring at high  $2\theta$  angles are shifted by relatively larger amounts than the lines at small  $2\theta$  angles. The reason for this is predicted by the Bragg equation, which, after differentiation, may be written

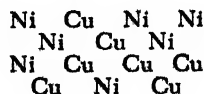
$$\frac{\Delta \theta}{\Delta d} = -\frac{\tan \theta}{d} \quad (8)$$

This equation shows that the shift in line position,  $\Delta \theta$ , due to a change of lattice spacing,  $\Delta d$ , increases as the tangent of the angle and reaches a maximum at  $\theta = 90^\circ$  and  $2\theta = 180^\circ$ , where  $\tan \theta = \infty$ . The high-angle lines occurring in the so-called back-reflection region of the pattern are most useful in determining changes in the lattice spacings.

**Substitutional Solid Solutions.**—Between the patterns of the pure metals presented in Fig. 18 is a pattern labeled Ni<sub>50</sub>Cu<sub>50</sub>, which represents a solid solution of 50 atomic percent of both nickel and copper. If the atomic arrangements of the pure metals in two dimensions are indicated as



the solid solution could be represented as



This is called a substitutional solid solution because the nickel and copper atoms may substitute one for the other and occupy the same relative positions as in the pure metals, although they are randomly mixed. The  $d$ -spacings, therefore, are between those of the two pure metals. The lines are shifted in the X-ray pattern by an amount that is dependent upon the composition of the solid solution. A smooth, nearly linear relation exists between the dimensions of the lattice and the chemical composition. The X-ray patterns of simple cases of the type illustrated here permit easy and rapid calculation of the intermediate cases.

**Phases.**—A single basic structure, called a phase, may extend over wide ranges of chemical composition. In the case just described, the same phase exists for pure nickel, pure copper, and all intermediate compositions. The atomic arrangement is the same for the entire series. Usually, however, only a limited solid solution can take place because the substituting atoms are very different in size, or for other reasons, and the phase will have a limited range of chemical composition. The X-ray method has great practical importance in the determination of phase-composition-temperature diagrams. Such diagrams form the basis for the production of many complicated metals and alloys. If a phase change occurs through heating or change of composition, it is revealed by the X-ray pattern. When the composition of a given phase is altered, the lattice dimensions also change and hence the boundaries in the phase diagram may be determined. This application of X-rays is widely used in the study of binary and ternary alloys, systems of oxides, carbonates, and the like. The application has also been used to detect small amounts of solid solution; for example, in the manufacture of the fluo-

when very small atoms fit into unoccupied interstices of the lattice instead of substituting for atoms in the lattice, so that the lattice dimensions remain nearly the same. An example is the addition of carbon to iron to produce steel. Accurate measurements of the density, in addition to X-ray data, are used to study the process. Density increases with the addition of interstitial atoms, and X-ray data show if specific compounds are formed at certain critical compositions.

**Deformed Lattices.**—The applications of powder diffraction discussed thus far have been confined to substances in their ideal crystalline state. If the substance is ground to colloidal-crystal size, strained beyond its elastic limit, cold- or hot-worked, rolled, or the like, the resultant lattice deformation has a marked effect on the X-ray pattern. X-rays are of great practical importance in studying these phenomena, and a few examples will be presented in the following paragraphs to show the general nature of these applications.

When a crystalline substance is ground into particles a few microns in size (the beginning of the colloidal range), the resultant X-ray powder lines broaden, the amount of broadening increasing with decreasing size. Although such X-ray patterns will not reveal absolute particle sizes, the technique is quite useful for determining relative sizes and for distinguishing between clusters of particles and true crystallite sizes. The equation

$$t = k\lambda / (b - b_0) \cos \theta \quad (9)$$

gives the basis for the measurement. The crystallite thickness,  $t$ , is the dimension perpendicular to the reflecting atomic planes;  $k$  is a constant

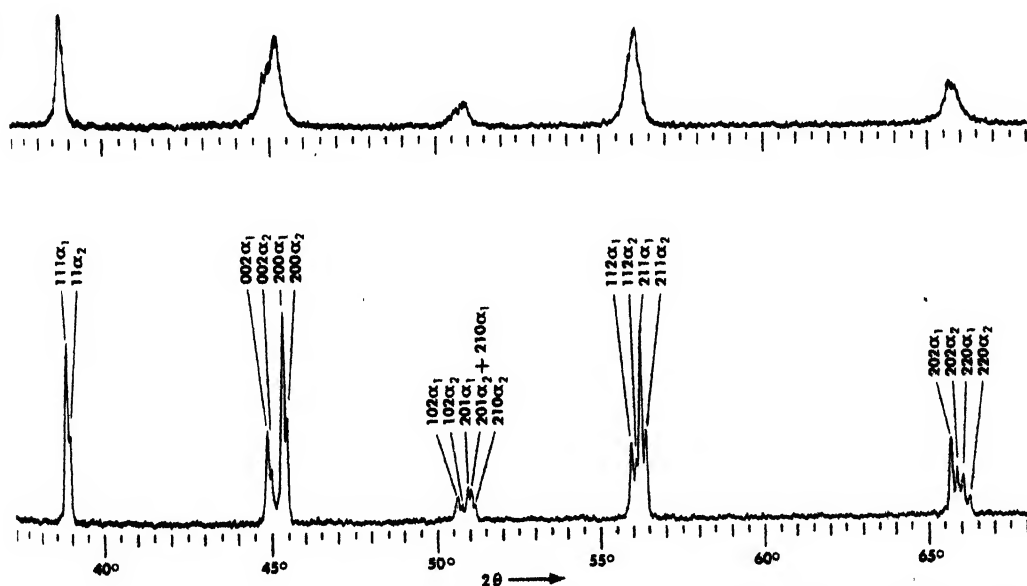


Fig. 19. Diffractometer patterns of barium titanate,  $\text{BaTiO}_3$ . Top, strained crystallites; bottom, strain-free ceramic.

rescent material zinc orthosilicate, in which 1 percent manganese substitutes for zinc.

**Interstitial Solid Solutions.**—Homogeneous phases known as interstitial solid solutions occur

usually taken as 1;  $b$  is the measured width of the diffraction line of the small-particle specimen; and  $b_0$  is the width of the line obtained with particles large enough not to cause line broaden-



ing, both  $b$  and  $b_0$  being measured under exactly the same experimental conditions. If the powder consists of small particles whose sizes embrace a large range, the X-ray measurement represents an average value because it is not possible to separate the overlapping broadenings. One application of the method has been the testing of the quality of catalysts. A good catalyst has a large surface area and hence small particle size. If the X-ray pattern is sharp, it is good evidence that the particles are too large.

When a substance is strained, the X-ray lines, particularly those at high angles, become broad and poorly defined. When the strain is removed by appropriate heat treatment (annealing), the lines return to their original sharpness, as shown in Fig. 19. This is a simple procedure to determine the correct annealing temperature. The method is also used to determine the effect of various types of mechanical treatment on the material.

**Crystals With Preferred Orientations.**—In the foregoing discussion the assumption has been that the crystallites in the X-ray specimen are randomly arranged so that all possible sets of atomic planes have an equal probability of reflecting. If this is not the case and if the crystallites assume certain special orientations, then the relative intensities of the lines of the X-ray pattern will be changed from their correct values; or, in extreme cases, some reflections may disappear, as shown in Fig. 20. The

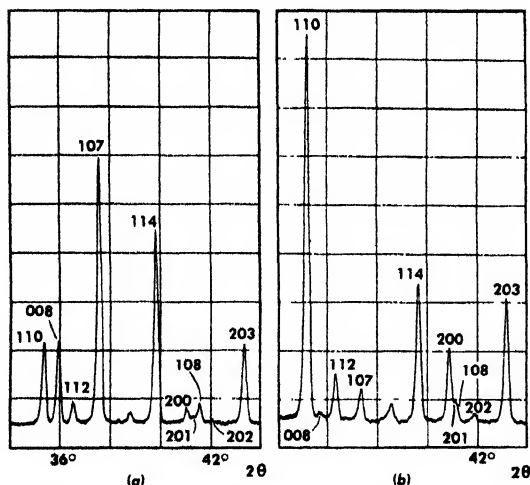


Fig. 20. Portions of diffractometer patterns of a commercial ferrite ( $\text{BaO} \cdot 6\text{Fe}_2\text{O}_3$ ) for (a) random arrangement of crystallites and (b) oriented crystallites. The 110, 008, 107, and 200 reflections have large differences in relative intensities because of the preferred orientation.

ability of X-ray patterns to elucidate such behavior provides a powerful tool for the study of many practical problems of the orientation of crystallites in fibers, wires, sheets, and foils.

Many electrodeposited metals tend to orient themselves in a preferred manner. For example, when selenium is plated on steel under certain conditions, it shows a marked preference for growing with its  $c$ -axis, the axis along the selenium chain of atoms, perpendicular to the steel surface; the  $a$ -axes, perpendicular to the chain, are more or less randomly oriented. X-ray diffractometer patterns show a large increase in intensities of reflections from the atomic planes

perpendicular to the  $c$ -axis relative to those of planes parallel to the  $c$ -axis. The latter are less likely to be in a position to reflect X-rays and may even disappear from the pattern. Electrical conductivity is much larger in the direction along the chain than perpendicular to the chain. The X-ray method affords an ideal way of following the plating conditions required to develop the best selenium electrical elements. Similarly, the magnetic properties of certain ceramic materials are enhanced by placing the powder in a magnetic field prior to firing so that the crystallites are oriented, resulting in the highest possible magnetic susceptibility for the material. X-rays are used to study this process, which cannot be followed with a microscope.

In the manufacture of drawn wire the metal crystals tend to become oriented with respect to the drawing direction but are randomly oriented around the wire axis. An X-ray powder photograph of a wire, therefore, shows discontinuities and marked variations of intensity around the circumference of the X-ray reflection. X-rays are also used to follow the effect of various treatments on the molecular orientation of natural and synthetic fibers such as ramie and nylon. The improved mechanical strength of the fibers and their physical properties can be correlated with the particular alignment of the molecules caused by extrusion and drawing.

The preferred orientation of crystals in rolled metal sheets may be influenced by the manufacturing method. The crystals tend to align with a certain rolling axis and in a particular orientation with respect to the rolling plane. The preferred orientation has a marked effect on deep drawing and similar operations. Careful control of the rolling process by X-ray analysis can produce special orientations, for example, in iron-silicon sheets used in transformer cores. The direction of easiest magnetization of iron-silicon crystals is parallel to the cube axes, and when this direction coincides with the rolling direction, the sheet has a high permeability.

**Amorphous Substances.**—The X-ray patterns of amorphous materials, such as glasses, resins

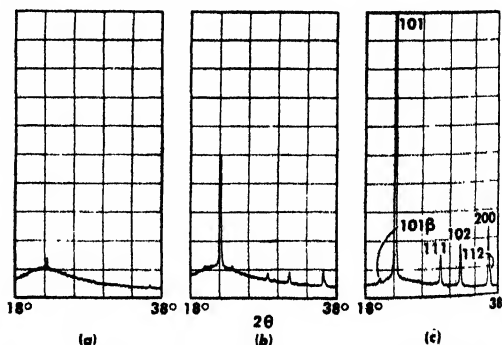


Fig. 21. Diffractometer patterns showing devitrification of a glass (95 mole percent  $\text{SiO}_2$  + 5 mole percent  $\text{K}_2\text{O}$ ) in alpha cristobalite ( $\text{SiO}_2$ ). (a) Powdered, untreated glass (b) material melted and heated  $\frac{1}{2}$  minute at  $1200^\circ\text{C}$  (c) material melted and heated 5 minutes at  $1200^\circ\text{C}$

and liquids, are distinctly different from those of crystalline substances. The atoms in an amorphous material do not have the symmetrical repeating arrangement so characteristic of crystalline materials. The X-ray patterns of amorphous

materials appear as one or two weak broad bands at small  $2\theta$  angles superimposed upon a continuous background. X-rays are therefore not useful in distinguishing between amorphous substances, but are ideally suited to show if a substance is crystalline or amorphous. The test is useful in many practical applications.

The X-ray diffractometer patterns of Fig. 21 show the progress of the devitrification (crystallization) of a silica glass. At the left is the broad diffuse band characteristic of glasses. The middle pattern shows the beginning of crystallization by the appearance of lines of cristobalite, a

pattern shows an increase in the intensity of the lines and further reduction of the band as the devitrification continues.

#### 4. X-Ray Tubes

An X-ray tube consists essentially of a cathode, which is a source of electrons; an anode or target, usually of a pure metallic element; and a means of applying high voltage to drive the electrons to the anode. There are two general types of X-ray tubes: gas-filled and vacuum. In the gas tube, electrons are emitted from a cold cathode by positive-ion bombardment. Gas tubes are not commonly used because their operating characteristics are critically dependent on the accurate control of the small gas pressure, and it is difficult to accomplish this regulation to the degree required for stable operation.

**Vacuum X-Ray Tubes.**—The principle of the vacuum X-ray tube was developed by Coolidge in 1913, and is the basis for the manufacture of most X-ray tubes now used. Some typical vacuum X-ray tubes are shown in Fig. 22. The electrons are emitted by a hot filament, usually a tungsten wire heated to  $2300^{\circ}$  to  $2400^{\circ}$  C, and the emission can be controlled by the filament current independently of the voltage applied to the X-ray tube. When the electrons are emitted, current flows between the anode and cathode. By using a high vacuum and by stabilizing the voltage and X-ray tube current, highly stable operating conditions are obtained, and the voltage and current may be easily selected by the operator. One of the problems in the development of vacuum tubes was to prevent contamination of the target and coating of the windows by tungsten evaporated from the filament. With modern tube technology this difficulty has been minimized.

The hard-glass, cylindrical vacuum-tube envelope is sealed to the metal anode end by means of a special metal-to-glass seal. The seal is an iron-nickel-cobalt alloy having a coefficient of thermal expansion close to that of the glass. The materials in the tube are thoroughly cleaned and outgassed, and an elaborate procedure is employed to assemble the tube, pump it to its required vacuum (a pressure smaller than  $10^{-6}$  mm mercury), and test it. Sometimes a "getter" material such as zirconium is included in the tube. After assembly the getter is activated to absorb the remaining traces of gases that may still be trapped in the tube after sealing. All portions of the tube must be designed with the capability of avoiding electrical failures at the high voltages used. For special researches a demountable tube with associated vacuum system is sometimes used.

The separation of anode and cathode depends

on the design of the tube and on the required maximum operating voltage. For lower-voltage tubes (about 50 or 60 kv) used in X-ray analysis, the separation is of the order of 10 to 35

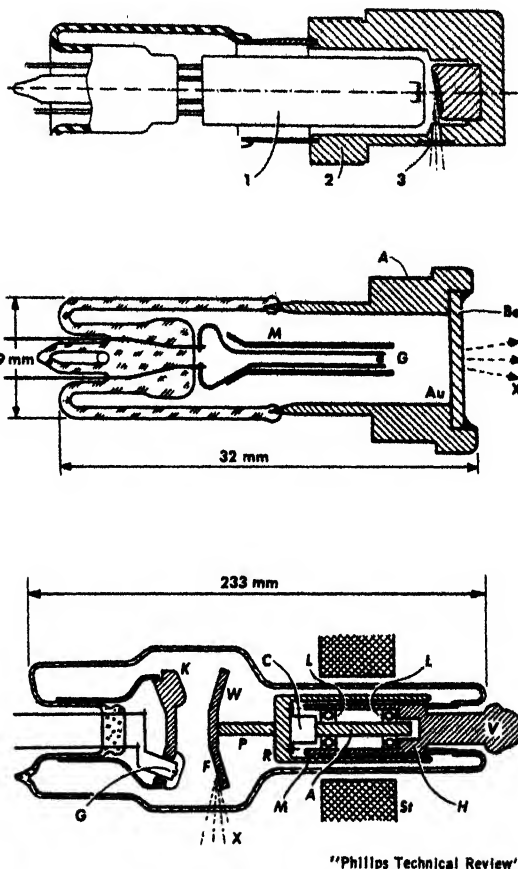


Fig. 22. Schematic cross sections of three Philips air-cooled X-ray tubes. Top: Tube for contact microradiography, 80 mm long, 5 kv, 10 watts. 1, cathode with tungsten filament; 2, anode block; 3, beryllium window  $50\mu$  thick. Middle: Miniature tube for surficial medical treatment, 25 kv, 2.5 watts. M, metal cylinder surrounding G, cathode; A, anode can holding beryllium window, whose interior has been coated with thin layer of gold for target; X, X-rays transmitted through target and window. Bottom: Rotating-anode tube for intermittent medical diagnostic use, 100 kv. K, cathode; G, filament; F, focal spot; X, X-rays; W, rotating tungsten anode with P, molybdenum pin, M, blackened copper sleeve for radiant cooling, and R, rator; S, rotating field of stator winding; A, spindle connected to R by thin cylindrical post C rotates in ball bearings L fixed in anode support H; V, high-voltage connection.

mm, whereas in multisection high-voltage tubes the electrons may travel several feet. The electrons are focused onto a small area of the target called the focal spot, focal area, or focal line. Only a small fraction of the electron beam produces X-rays. The efficiency of X-ray production increases with applied voltage, being less than 0.1 percent at low voltages, about 1 percent at 100 kv; 10 percent at 2 Mv (million volts), and about 50 percent at 15 Mv.

At low voltages most of the electrons dissipate their energy in the form of heat; and provision must be made to cool the anode. This is done either by forced circulation of water or oil

in contact with the outside of the target, or by air cooling. Metals such as tungsten, molybdenum, and copper are satisfactory targets because they have the high thermal conductivity or melting point and the low vapor pressure required to withstand the high localized heating in the focal spot.

The size of the focus and the method of cooling determine the maximum permissible power that may be applied to the tube. For example, a copper-target, air-cooled diffraction tube with a focus size of 1 by 10 mm may be operated continuously at about 100 watts (total load) or 10 watts per square millimeter (specific load). By water-cooling the same tube the power may be increased safely by a factor of 7 to 10. A further similar gain may be achieved by making the target in the form of a disk about 2 or 3 inches in diameter with the focal spot near the edge. By rapidly rotating the target a cooled portion is always presented to the electron beam, but the position of emitted X-rays remains stationary. If the focus is greatly reduced in size, say below  $50\ \mu$  ( $\mu = 1\ \text{micron} = 0.001\ \text{mm}$ ), the specific load can be of the order of 1,000 watts per sq mm. For a  $1\text{-}\mu$  focus the specific load can be further increased; it is usually limited by the electron emission from the cathode rather than by target cooling.

The X-rays emitted by the tube are generated very close to the surface of the target. For the soft X-rays it is necessary to provide one or more low-absorbing windows near the focal spot to transmit the X-rays out of the tube with a minimum loss of intensity. For this purpose mica about  $10\ \mu$  thick or beryllium from 50 to  $1,000\ \mu$  thick is frequently used. The tube is usually mounted in an X-ray-proof metal housing (with a shutter over the window), and the high-voltage cable is generally shockproof to minimize the hazards involved in using such equipment.

The apparatus for controlling and operating the X-ray tube usually consists of electronic regulators to stabilize the X-ray tube voltage and current, and meters to read the values; rectifier tubes and a capacitor to convert the a-c line power to d-c constant potential; a variable autotransformer (Variac) calibrated in kilovolts for selecting the voltage; a filament-heating transformer; protective circuit breakers and interlock switches to prevent contact with the high voltage; a water supply for cooling the tube and transformer, with associated cutoff switches in case the water flow falls below a preset amount; and the high-voltage transformer. For X-ray analysis the entire assembly is usually housed in one metal cabinet.

**High-Voltage Sources.**—X-ray tubes for diffractometry and spectrography are usually operated below 60 kv. For radiographic examination of thick or highly absorbing materials it is necessary to use higher voltages because the penetrating power increases with voltage. X-ray tubes have been developed that operate up to about 400 kv. For voltages up to 1 or 2 Mv it is necessary to use multisection tubes in which the X-rays pass through the target and emerge from the end of the tube.

The Van de Graaff generator (see PARTICLE ACCELERATOR) has been used as a source of X-rays above 1 Mv. The electrostatic charge is carried by a rapidly moving insulated belt to the high-voltage terminal, which is connected to the cathode of a multisection X-ray tube.

The linear accelerator has been used for voltages of the order of 6 to 8 Mv. It consists of a wave guide with an axial electric field in which the electrons from an electron gun are accelerated using radio-frequency power supplied by a klystron (see ELECTRONICS—*Microwave Electronics*). The electron energy increases at the rate of about 1 Mv per foot, and the high-energy electrons strike a transmission-type target placed at the end of the wave guide.

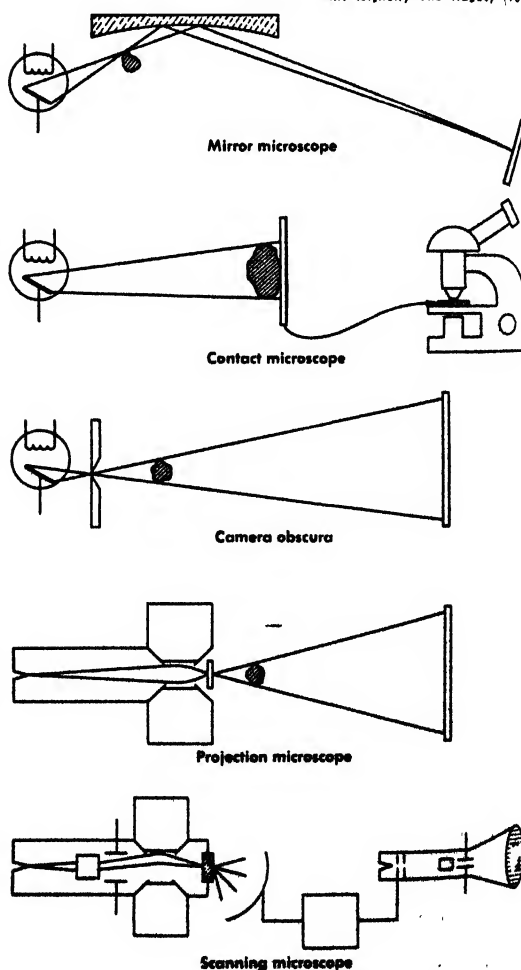
The betatron has been used to generate X-rays in the 15 to 30 Mv range. Electrons are injected tangentially into an evacuated doughnut-shaped glass tube that is surrounded by a magnetic field. The field guides the electrons around the circle and continually accelerates them. After they have achieved the desired energy they are magnetically guided out of the circular field to strike a target and produce X-rays.

## 5. X-Ray Microscopy

The possibility of using X-rays for microscopy would appear attractive because of the poten-

Fig. 23. The five types of X-ray microscopes. The upper three employ conventional X-ray tubes, while the lower two require demountable point-focus tubes with electron-focusing devices.

Ong Sing, Poen, "Microprojection With X-Rays,"  
M. Nijhoff, The Hague, 1959



tially great resolving power that would be possible using short-wavelength radiation. Fig. 23 shows the five types of X-ray microscope that have been developed. Although the problem of designing X-ray microscopes has been intensively studied, their development has been slow because of technical difficulties and the special problems involved in accurately focusing an X-ray beam. It is not possible to make lenses for X-rays, because for X-rays the refractive indices of all substances are slightly less than one. Hence it is necessary to reflect the X-rays to form an image. (Here the word "reflection" is used in its true meaning and not as a synonym for diffraction, as was the case in several previous instances.)

At angles above grazing incidence X-rays penetrate the surface and are absorbed or transmitted, as explained in section 2. *X-Ray Spectrochemical Analysis* (X-Ray Absorptiometry). However, X-rays are nearly totally reflected at very small glancing angles. The critical angle for total reflection increases with wavelength and atomic number of the reflecting element. It is generally less than 30 minutes of arc and reaches only  $3^\circ$  for 8.3-A X-rays reflected from gold. The reflecting surface must be a precisely formed concave surface of large radius finished to about 10 Å, which is at least an order of magnitude finer than the best optical surfaces. In addition to the great difficulty of preparing such surfaces, the images suffer from various aberrations that limit definition. The resolution that has been achieved is about the same as that of a good optical microscope, and the exposure times are long, often an hour or more. Diffraction from doubly curved crystals has also been used in attempts to make a microscope, but the results have not been any more successful than those using mirrors because of the limited perfection and low reflecting power of the crystals.

The great penetrating power of X-rays, and the fact that their absorption is dependent on the elemental composition of the specimen, make it possible to use X-rays for new types of microscopic studies. The methods and results are totally different from those of optical and electron microscopy. The two methods commonly used, contact and projection microradiography, are described below. They are similar to normal X-ray radiography in that the X-ray transmission image of the object is recorded on film.

**Contact Microradiography.**—The simplest method of X-ray microscopy is known as contact microradiography. In this method a thin specimen is placed directly on a fine-grained photographic plate and exposed to X-rays. The specimen is removed, and after the plate is developed it is examined with an optical microscope. Selected regions are enlarged photographically because there is no magnification of the original X-ray image. The resolution is about  $1\ \mu$  (with special care  $0.2\ \mu$  has been achieved), and is determined primarily by the grain size of the photographic emulsion and the resolving power of the optical equipment used for the enlargement. The specimen should be of the order of 1 or  $2\ \mu$  in thickness and in close contact with the plate to avoid penumbra effects; however, good results have been obtained with specimens over  $200\ \mu$  thick. The contrast on the plate is determined by the X-ray absorption in the specimen. Thus for biological specimens, which con-

sist of low-atomic-number elements and hence have low X-ray absorption, soft X-rays (0.5 to 5 kv) are used, while for metallurgical specimens more penetrating X-rays (up to 30 kv or more) are required. The field of view in this method is larger than in the projection method.

**Projection Microradiography.**—If the focal spot of the X-ray tube is extremely small, the specimen may be placed close to it and at some distance above the photographic plate to obtain a magnified image. This method is called point-projection microradiography. The magnification is determined by the ratio of the distances from the focal spot to specimen and specimen to plate. Initial magnifications of 10 to  $100\times$  may be obtained and further magnification may be done photographically, as in contact microradiography. The definition of the image is determined primarily by the size of the focal spot, which should be of the order of  $1\ \mu$  in diameter. If a normal-size focal spot is used with a very fine pinhole (camera obscura), the intensity is generally too low for practical use because the specific loading of the target (see section 4. *X-Ray Tubes*) is relatively low in such cases. With extremely small focal spots the specific loading is much greater, but the demountable tubes used require a special cathode, electron-focusing system, and vacuum arrangement.

**Microradiographic Applications.**—Both the contact and the projection methods give sharply imaged photographs. The optical microscope has only a small depth of focus at high magnification and hence cannot be used for stereophotographs; however, it is possible to obtain remarkable three-dimensional pictures with X-rays. Two separate exposures are made, the specimen being tilted between exposures. When the pair of plates is observed with a stereo viewer the spatial relationships are seen clearly and can be measured. This method has been used to obtain photographs showing details of the structure of such things as plants, insects, and paper that could be obtained in no other way.

The blackening of the film is dependent on the elemental absorption of X-rays in the specimen, and hence it is possible to make quantitative analyses on very small sample volumes with moderate precision. A step-wedge set of filters of known absorption is placed beside the sample and both are simultaneously exposed to the X-ray beam. The absorption in different parts of the sample can be calculated by comparing the film density at different parts of the microradiograph with the film density of the step wedge. Arne Engström has used the method in biological and medical studies with great success. As little as  $10^{-13}$  gram of an element has been determined in samples where the concentration was as small as 1 percent with an accuracy of 5 to 10 percent.

The circulation of blood in the ear of an anesthetized rabbit has been studied by injecting an X-ray-opaque suspension into the blood vessels and making serial exposures (microangiography). Living insects, botanical specimens, human skin, liver and kidney sections, nerve cells, and other materials normally studied in pathology and histology are but a few examples of the enormous variety of biological materials investigated by microradiography. There are also many inorganic applications, such as the location and identification of inclusions, precipitates, and segregations in steels and light-metal alloys. The diffusion of one metal into another

can be followed. The X-ray study of fossils, such as foraminifera and other microspecimens, often reveals details of the internal arrangement that cannot be seen by other methods. The distribution of fibers and filler in papers has been extensively studied by microradiography. (See Plate 3.)

## 6. Radiography and Fluoroscopy

The use of X-rays to obtain photographs of the interior of objects that are opaque to visible light was applied shortly after Roentgen's discovery of these rays. The method is now widely used in industrial and medical applications. The apparatus is basically simple. The object to be photographed is placed between the X-ray tube (or gamma-ray source) and the film cassette. The image shows the X-ray transparency of the three-dimensional object projected onto the flat film. Regions of high X-ray absorption in the specimen cause less blackening of the film than do regions of low X-ray absorption.

In fluoroscopy the apparatus arrangement is identical to that of radiography, except that the film is replaced by a fluorescent screen to permit direct viewing of the image. The advantages over radiography are that both the film developing time and the cost of the film, which may be as much as one half of the total X-ray inspection cost, are eliminated. The disadvantage is that the image has poorer quality because of the graininess and diffusion in the fluorescent screen. In photofluoroscopy the image on the fluorescent screen is photographed with a small camera; this has the advantage of a permanent record, but the small photograph has poorer quality than the large direct photograph. The film is sometimes placed between a pair of fluorescent screens so that the light from both screens serves to intensify the image on the film, although this causes some loss of definition. Xeroradiography, in which an electrostatically formed image is obtained, has been used in place of film and fluorescent screens in certain applications.

For a given X-ray tube voltage, the product of the tube current expressed in milliamperes (ma) and the exposure time in seconds is referred to as the exposure, which is expressed in milliamperere-seconds (ma-sec). In radiography the continuous radiation is used. The X-ray output of the tube may be increased by increasing the voltage or the current, but the penetrating power can be increased only by raising the voltage. Since monochromatic X-rays are not used and since the object may have a non-uniform thickness, the exposure times can be calculated only roughly, and a few trial exposures may be required to obtain the optimum contrast. The elemental composition of the object is most important in determining exposure time and the selection of the X-ray tube voltage. For example, 200-kv X-rays are transmitted with approximately equal intensity through 1.2 in. of steel and 0.1 in. of lead.

The same geometric laws of shadow formation that are used for visible light apply to X-rays. Hence the sharpness of the image on the film is dependent on the size of the X-ray focus, the thickness of the object being X-rayed, the closeness and parallelism of the object, and the film. The smaller the focus and the thinner the object, the sharper the image. The definition becomes distorted when each point of the object casts a shadow that overlaps with the shadows from adja-

cent points. Increasing the distance between the focus and the film aids in improving the definition, but the intensity at each point in the photograph is reduced by the inverse square of the distance.

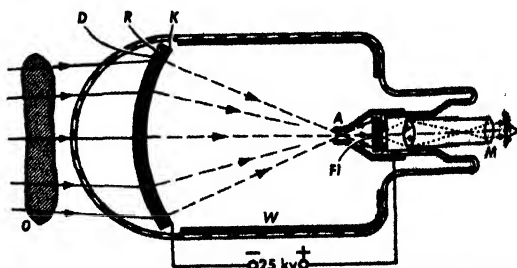
Scattering, diffraction, and fluorescence originating in the object, the film cassette, portions of the apparatus, or floor and walls of the room add to the background on the film, thereby reducing the contrast. Scattering is reduced by means of lead-foil screens surrounding the film to absorb the softer radiations, the use of a thick lead sheet on the back of the film cassette, and the use of various diaphragms to limit the beam.

In order to obtain perspective, it is necessary to make a pair of radiographs by moving the X-ray tube a distance equal to the separation of the eyes and to view the pair with a stereoscope.

**Applications.**—Radiography is used in a large variety of applications, such as to find gas holes in aluminum-alloy castings for aircraft; to inspect welds; to exercise quality control of electronic components such as vacuum tubes, resistors, and printed circuits; to detect porosity and shrinkage cavities in castings; to locate segregations in alloys; and to find cracks, ruptures, inclusions, and other defects in metallic bodies. (See Plate 4.)

Flash-radiographic systems have been developed that can photograph a rapidly moving object in a fraction of a second. A special X-ray tube with a field-emission cathode is used in conjunction with a capacitor charged to the required voltage. The capacitor is discharged by a triggering electrode, causing current to flow to the anode and produce a high-intensity burst of X-rays.

**Image Intensifier.**—The image intensifier is an evacuated glass tube in which an X-ray fluorescent screen and photocathode are mounted, as shown in Fig. 24. X-rays entering the tube strike the fluorescent screen, and the emitted light causes electrons to be released from the photocathode. The number of electrons released from each point on the cathode is proportional to the luminous intensity of the screen at that point and hence also proportional to the incident X-ray intensity.

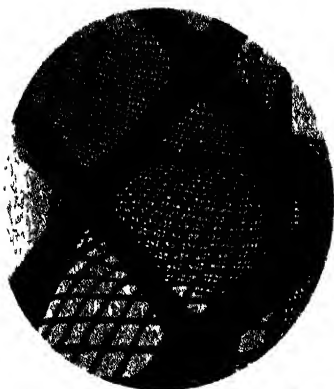


M. C. Teves, "Philips Technical Review," 1955

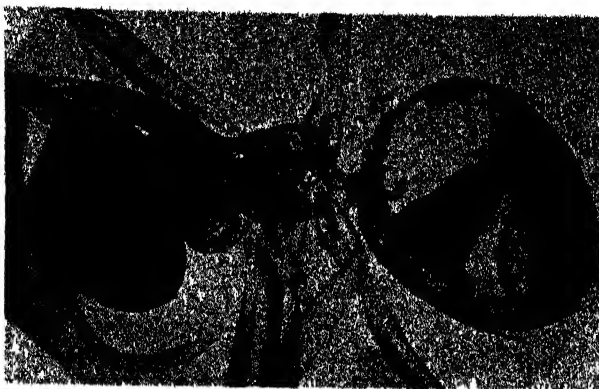
Fig. 24. Schematic cross section of image-intensifier tube. O, object exposed to X-rays; D, support carrying R, the first fluorescent screen, and K, the photocathode; A, hollow anode surrounding FI, the viewing fluorescent screen; M, viewing microscope; W, conductive coating on interior of evacuated glass envelope.

An electric field focuses the electrons so that the image is reproduced, reduced by a factor of about 9, on the viewing fluorescent screen. The electrons cause visible fluorescence and the luminous image can then be viewed by a simple microscope or binoculars with about  $9 \times$  magnification, so that the image is seen in its original size. This





Above: 1,500-mesh-per-inch silver grid wire, showing large depth of focus and exactly correct perspective.



Upper right: Ant, showing internal structure. Gold target, 10 kv.

Right: Diatoms (Arachnoidiscus), gold-shadowed.

Far right: Tissue paper, treated with alcohol-iodine solution to enhance fiber contrast.



Far left: Sandstone, mounted on 75-mesh-per-inch copper grid. Cu target.

Left: Same field and specimen as for (far left), but Fe target. Specimen contains an iron-bearing mineral that strongly absorbs the Cu radiation and transmits the Fe radiation. By comparing the two photographs the exact distribution of iron can be

# X-RAY MICRORADIOGRAPHY

Left: Thin section of bone. White areas have greater X-ray absorption than black areas. Osteocytes and differences in density of mineralization are clearly visible.

Center: Microscope view of same section as far (left) in ordinary light. Note that mineralization does not show.

Right: Microscope view of same section in polarized light.

The three bottom right panels are contact microradiographs. All others are projection microradiographs. (Top row) Ong Sing Poon, "Microprojection with X-Rays," Martinus Nijhoff, The Hague, 1959; Ong Sing Poon, "Second row) Ong Sing Poon, "Microprojection with X-Rays"; Ong Sing Poon. (Third row) Ong Sing Poon. (Bottom row) R. Amprino and A. Engström, "Studies on X-Ray Absorption and Diffraction of Bone Tissue," Acta Atomica, S. Karger, Basel/New York, 1952



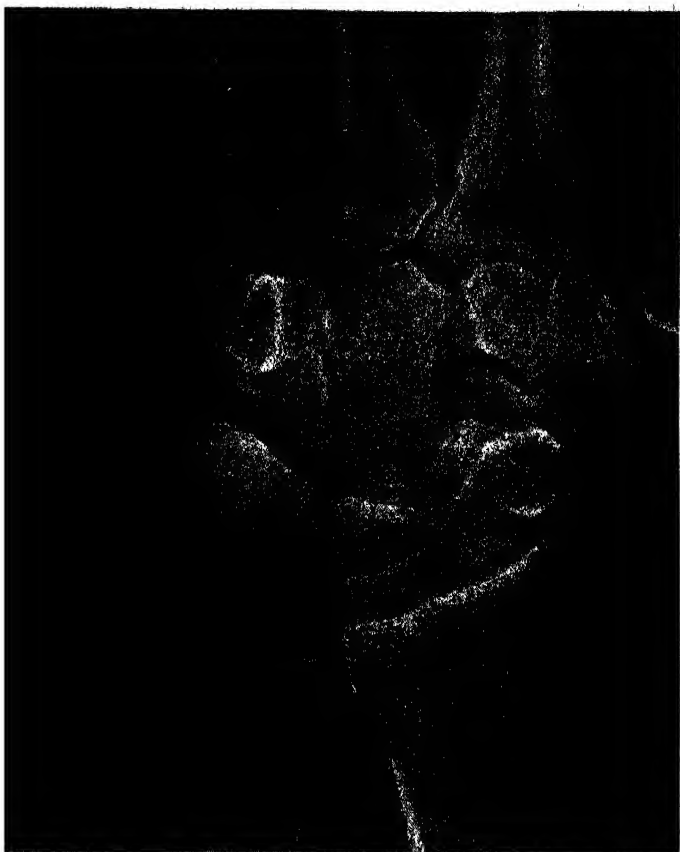


PLATE 4

X-RAYS

Left: Human wrist. X-ray absorption in bone is much stronger than in surrounding flesh, and bones appear as light areas. Where bones are superimposed, additional absorption outlines the details of overlapping bone structure.

#### RADIOGRAPHY

(Left) St. Francis Hospital, Evanston, Ill.; (below) Philips Electronic Instruments; (bottom, left right) from "Roentgen Examination of Paintings" Stanley H. Macht, M.D., and Bruce Etchison, The American Journal of Roentgenology, Radium Tl and Nuclear Medicine, Detroit, Mich., November

Right: Electron tube and microphone. X-rays used for checking internal structure not visible to eye for quality control. Both pictures are two-minute exposures on single-emulsion film obtained with a fine focus (0.4 mm) X-ray tube operated at 120 kv, 5 ma.

Below: This portrait of George Washington was examined to determine whether it was one of many painted by Gilbert Stuart. By comparing the roentgenographic study (below right) with one of an authenticated Stuart work, similarities and differences were noted, and it was established that this was not the work of Stuart.



image, however, is much brighter than the original image on the first fluorescent screen. This intensification results from two factors. First, the high voltage applied between the photocathode and viewing screen imparts high energy to the electrons, thereby increasing the fluorescence intensity on the viewing screen to 10 to 15 times that on the first fluorescent screen. Second, the size of the image on the viewing screen is reduced by 9°, so that the light is emitted from an area 81 times smaller than the first screen. The product of these two factors gives a gain in intensity of from 800 to 1,200, and the image resolution is as good as that of the fluorescent screen normally used in fluoroscopy. Hence it is possible to decrease greatly the normal X-ray dose received by a patient in, say, chest fluoroscopy and also enable the patient to be examined in a room with moderate lighting without the physician requiring eye adaptation. The increased intensity also makes possible X-ray motion pictures without excessive radiation dose to the patient. The image intensifier has also been used in many types of industrial radiographic examinations.

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## 7. Medical Uses of X-Rays

With the advent of X-rays mankind gained one of the most powerful tools in the long history of medicine. For the first time it became possible to peer into the innermost recesses of the body without the aid of the surgeon's scalpel. It also became possible to apply medical diagnostic methods to hitherto completely inaccessible areas of the human body by painless, efficient techniques. Few discoveries have had such far-reaching effects and universal application as that of Roentgen. His X-rays are employed all over the world and have made an immeasurable contribution to the early diagnosis, control, and treatment of disease. It is equally true that the full possibilities of X-rays are not yet understood and that increasing uses of them may be achieved in the future.

The term "radiology" is used to designate those branches of medicine concerned with X-rays, other ionizing radiations, and radioactive substances. From the beginning the diagnostic uses of X-rays have been chiefly divided into fluoroscopic and radiographic techniques. X-rays are also employed as a method of treatment and have a wide application ranging from the acne or pimples of the adolescent to the widely prevalent bursitis or shoulder pain and deep-seated cancers in remote areas of the body. See **RADIOTHERAPY**.

**Fluoroscopic Techniques.**—Frequently, fluoroscopic examination of portions of the human body precedes other X-ray methods and constitutes a way of examining the body in motion. It is accomplished by placing the patient between the X-ray tube and a special fluorescent screen. When the rays strike the screen they cause the particles in the screen to glow strongly enough to be easily seen in a completely darkened room. When the patient is placed between the X-ray tube and the screen, the difference in density of various parts of the body causes a varying shadow to be cast on the screen, enabling the observer to distinguish between different parts of the body. This effect is further enhanced if the observer has accommodated the pupils of his eyes by wearing special goggles before going into the darkroom. In addition, various techniques are adopted to accentuate

ate contrast in this method, such as the use of radio-opaque solutions that cause a dense shadow to be cast on the screen.

One of the most frequent uses of fluoroscopy is in the investigation of the alimentary canal or digestive system. This method was pioneered by Dr. Walter Bradford Cannon (1871-1945). In order, for example, to diagnose disease of the esophagus or swallowing tube, the patient is given a solution to drink that is sufficiently dense to cast a clear-cut shadow on the fluorescent screen. The opaque medium usually employed here and for other parts of the digestive system is barium sulphate. The patient stands behind the screen in the darkroom holding a glass of barium sulphate, and the observer takes a position in front of the screen with the controls of the X-ray unit at hand. The patient is then told to drink from the glass, and on the screen the observer is able to see the entire swallowing process and follow the barium into the stomach. If there is any adverse condition affecting the esophagus, such as inflammation, a swallowed bone, or a tumor, the drink of barium sulphate will outline the effect of the condition on the structure of the esophagus. For example, if the patient had swallowed, whole, a chunk of meat that had lodged midway down the esophagus, the barium sulphate would stop at that point and indicate just where the meat was located. If it became necessary to operate, knowledge of the exact location of the obstruction would be of extreme value to the surgeon.

A similar technique is employed for investigation of the stomach. The stomach is filled with barium sulphate and outlined on the fluorescent screen. The motion and action of the stomach are clearly seen, and abnormalities of function as well as structure may be identified. Examination of the large colon or intestine is also carried out by this method. In this case the barium sulphate is administered as an enema from the rectum and the observer is able to visualize the rectum and the colon. Many persons have been saved from cancer by having the curable conditions that precede cancer in the colon discovered and corrected in time.

Examination of the heart as a moving organ is best done with the fluoroscopic screen. Where previously doctors labored with listening and tapping aids to draw a mental picture of their patients' hearts, it now is possible to see the heart in its functioning state and to watch it expand and contract. At the present time this method has become so well accepted that it is a rare heart specialist who does not have a fluoroscopic device in his office for this purpose. At the same time that the heart is examined the lungs are inspected and the movement of the diaphragm is observed.

The fluoroscopic screen has different uses for the various specialties in medicine. The orthopedic or bone surgeon checks fractures with it. The industrial or military surgeon uses it to locate metallic fragments resulting from industrial accident or military gunshot. The pediatrician or baby doctor looks for an inhaled candy ball or toy. The chest physician searches for early evidence of lung tumor. This partial list of present uses of fluoroscopy is continually being expanded.

**Radiographic Techniques.**—Techniques to obtain a picture of some part of the interior of the body are now standard medical practice all over the world. These methods differ from fluoroscopy in that a still picture is obtained, with no indication of the motion of the part X-rayed except

when enough separate films are taken to simulate a cycle of motion. These stills, however, play a most important role in medical diagnosis and generally show a finer detail throughout than it is possible to obtain on the fluoroscopic screen.

An enumeration of all the uses of X-ray films would be extremely lengthy. Suffice it to say that there is no part of the body that is exempt from the probing of the X-ray eye and that medical diagnosis has become markedly dependent upon X-ray findings, so much so that a complete medical specialty has grown up around Roentgen's discovery and doctors devote years to training in the various aspects of X-ray technology.

The uses of special substances to show organs in the body reach into many branches of medicine. The kidney specialist may wish to determine the location and effect of a kidney stone. There are available to him several medications that, when injected intravenously, will render opaque the internal kidney structures as well as the tubes leading to the urinary bladder and the bladder itself. In some cases he will inject the contrast medium through an instrument inserted from below into the bladder. X-rays taken at this time show the structures in considerable detail and enable the physician to locate the site of disease.

The gallbladder is a relatively frequent offender. A contrast medium has been perfected that, when taken by mouth, will render the gallbladder dense enough to be seen on an X-ray film. In this way gallbladder function and the possibility of stones are determined. Even after the gallbladder is removed there are ways of studying the remaining bile passages with contrast media and X-ray films.

The problem of sterility, or inability to bear children, has come under X-ray observation. The specialist may inject material that will render the female reproductive tract opaque and show the structures on X-ray film. In this way the exact cause of sterility may be found and its correction attempted. Following conception, X-rays are used to measure the female pelvis in order to determine whether the unborn infant can pass safely down the birth canal. By means of this technique, many children are now delivered safely, whereas formerly they might have hemorrhaged intracranially and as a result been born with brain damage and paralysis because of small maternal passages.

X-ray studies have been of great assistance to the neurologist and neurosurgeon. X-ray photographs of the skull and spine may point the way to the diagnosis. Specialized techniques are also available. For example, in the diagnosis of spinal-column disease the specialist may inject an opaque solution and watch its passage up and down the spinal canal with the fluoroscope. He may also inject air for special brain studies, especially to diagnose and locate brain tumors.

Preventive medicine has benefited vastly by the employment of X-ray techniques. Chest surveys for the early diagnosis of tuberculosis, with resultant decreased time of treatment and diminished risk to contacts, are a commonplace. This screening technique has been applied in government, industry, the armed services, and community life.

Many advances have been made in refining techniques for the purpose of early diagnosis, especially in the heart and cancer fields. Methods of showing the inner structures of the heart are of particular importance to children born with de-

fective hearts who had previously been condemned to ever-constricting activity and ultimate death. These cases include the so-called blue babies, babies with a faulty circulation of the blood that causes them to have a bluish cast. Diagnostic methods now make possible an early determination of just where the heart defect may be and enable the surgeon to utilize appropriate surgical techniques.

Another development of note enables the radiologist to take films at designated levels in the body in an attempt to determine more precisely the site of disease. This technique is known as laminography and is particularly important in the chest, where tuberculous cavities must be located precisely for the chest surgeon. For the further determination of depth and for the localization of objects within the body, a stereo technique called stereoradiography is employed. In this method, two films are exposed following a small shift in position of the X-ray tube corresponding to the distance between the radiologist's eyes. The object being X-rayed remains stationary. The two films are then viewed in a stereoscope so that the illusion of depth is achieved. This method is used, for example, to localize a foreign body in the skull preparatory to surgical removal.

The X-ray apparatus used for radiography and fluoroscopy is undergoing constant change and there is a steady flow of specialized accessories designed to facilitate more modern procedures. One of the most notable of these is an electronic device that increases the brightness of the fluoroscopic image. See also *VETERINARY MEDICINE—Practice (Specialization): Radiology*.

**Radiation Hazards.**—The hazards of X-rays are being reemphasized in this age of atomic radiations. Improper use may result in damage being done to all personnel concerned, and the history of radiology is replete with its martyrs. This means, in effect, restricting X-ray procedures to those types of disease in which the expectation of useful and pertinent information is a reasonable one. In addition, there should be full employment of protective devices and techniques directed principally toward reducing the amount of radiation received by the patient, the physician, and the technical staff. These include the proper use of leaded shields, modern equipment, and skilled technicians.

The government has begun to exert its influence on safety requirements, and inspection for compliance with existing regulations may become a routine occurrence. At the same time it must be stated that the preeminent position of the X-ray method in the diagnosis of disease should not be downgraded because of radiation hazards. In the hands of skilled technicians and well-trained radiologists, the risks can be reduced to a minimum and the great benefits retained.

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**XY COMPANY**, the popular name of the New North West Company formed in Canada in 1798 by a union of Montreal fur firms and discontented North West Company men. The new company marked its goods with the letters XY. After a bitter struggle which was injurious to both enterprises, the XY Company was absorbed into the older company in 1804, receiving a one-fourth interest in the new combine.

**XYLEM**, zī'lem, that part of the vascular system of the higher plants which functions in the conduction of water and various substances in solution from the roots to all parts of the plant. Xylem also gives major support to the plant body in woody plants and serves to some extent in food storage. The trunks of trees consist largely of xylem.

Xylem is a complex tissue. In the mature tissue, part of the cells are living; others are mere cell skeletons. The basic cell type is the tracheid, from which are derived by evolutionary specialization the fiber and the vessel element. Fibers, the major support of xylem, have very thick walls. The vessel element is the unit of a series that, united, forms the pipeline-like vessel. Associated with these nonliving cells in the formation of a longitudinal system are rows of small living cells, the xylem or wood parenchyma. Other living cells, lying in radial sheets, form a transverse system, the xylary or wood rays, often conspicuous in the grain of wood.

Xylem, in mass or in strands, is present in all parts of the plant: stem, roots, leaves, floral organs, fruits. In tree trunks, in the older branches, and

in the older roots of woody plants, the first-formed xylem ultimately ceases to function except as support, and becomes heartwood. Heartwood, especially important as lumber, has no living cells and is permeated by preservative, and other substances that commonly give it a dark color, distinguishing it from the outer, younger sapwood.

See also PLANTS AND PLANT SCIENCE—2. *Anatomy* (Primary Body) and (Secondary Body).

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**XYLOGRAPHY.** See WOOD ENGRAVING AND WOODCUT.

**XYLOPHONE**, zī'la-fōn, a musical instrument of the percussion family. As the name suggests (literally "wood sound"), it consists of tuned bars of hardwood in keyboard arrangement, graduated in length to provide a chromatic scale of three to four octaves. The bars have metal resonators and are mounted upon cords on a tablelike frame. The performer stands and uses special hammers or sticks (usually wooden) to strike or sound the wooden bars.

Primitive forms of the modern xylophone were developed in Asia and Africa and introduced into Europe during the Renaissance period under various names, including *Strohpfedel* or strawfiddle. During the 19th century the special virtuoso and tonal qualities of the instrument became widely known. Camille Saint-Saëns made effective use of the xylophone in his popular symphonic poem *Danse Macabre* (1874). Gustav Mahler, Igor Stravinsky, Dmitri Shostakovich, and numerous other 20th century composers have given it a prominent role in the symphony orchestra. Its importance in popular music is overshadowed by the marimba (q.v.), a similar instrument closely identified with Central American music, and the vibraphone (q.v.), used in dance bands and jazz groups.

WILLIAM BRACY.

**XYLOPIA**, zī-lō'pī-ə, a genus of some 160 species of trees and shrubs in the predominantly tropical family Annonaceae. The generic name is a modification of the pre-Linnaean name *Xylopicrum*, which was derived from the Greek *xylos*, wood, and *pikros*, bitter, referring to the taste of the wood. *Xylopi* is unique in that it is the only annonaceous genus (of about 120 in the family) with species growing in the tropics of the New World, Africa, and Asia. The leaves are often coriaceous, oblong to elliptical, entire-margined, and usually borne in two ranks. The flowers, borne singly or in clusters, have a distinctive three-angled corolla comprised of two whorls of six fleshy, elongate petals. The three inner petals, slightly shorter than the outer three, have a swollen concave base which fits compactly over the numerous minute stamens and carpels borne on the enlarged receptacle. The anthers on the stamens are transversely septate; the pollen grains usually are shed in groups of four, and thus are visible to the naked eye. The carpels are borne in a craterlike depression in the center of the receptacle; after fertilization the fruits become subcylindrical elongate berries containing two rows of seeds characterized by ruminated endosperm.

The black dried fruits of an African species (*X. aethiopica*) have been called "Guinea peppers," and were once of commercial importance in Europe as a tangy condiment and/or drug. At



present the fruits are used locally by native tribes as a cough medicine and purgative. The dried fruits of three Brazilian species (*X. aromatica*, *X. sericea*, and *X. frutescens*) also have a limited pharmaceutical use; for example, in treatment of fevers. The wood of *X. frutescens* and *X. sericea* is relatively dense (specific gravity 0.626), and is used by Indians in house construction. The bark of these species also has a limited use for cordage and in making crude textiles. The wood of *X. aethiopica* is quite flexible and has been described as termite-proof. It is utilized for bows in the area formerly called Togoland, as well as for house posts, masts, and boat paddles throughout west-central Africa.

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**XYRIS.** See YELLOW-EYED GRASS.

**XYSTUS.** See SIXTUS.

**XYZ CORRESPONDENCE**, in United States history, the name given to the reports made to President John Adams by an official commission which was rebuffed in its efforts to negotiate a treaty of commerce and friendship with France in 1797–1798. The attendant circumstances, known as the XYZ Affair, marked a low point in relations between France and the United States and brought the two nations close to war.

The French Directory had been angered by the conclusion in 1794 of Jay's Treaty (q.v.), which resolved differences between England and the United States, and in retaliation had stepped up its harassment of American shipping. In the 12-month period ending in June 1797, French ships had captured 316 vessels flying the American colors. In an effort to restore amity with the Continental power, President George Washington dispatched Charles C. Pinckney, a Southern Federalist, to Paris in December 1796. The Directory flatly rejected this conciliatory gesture. It not only refused to recognize the envoy but even threatened to arrest him if he did not quit the country, and Pinckney, incensed by the insult, departed for the Netherlands.

This serious rupture in diplomatic relations between the former wartime allies confronted John Adams when he assumed the presidency the following March. Determined to avoid the open conflict which threatened, he sent to Paris a three-member commission composed of Pinckney, John Marshall, another Federalist, and Elbridge Gerry, a Massachusetts Republican and Francophile. Soon after their arrival on October 4 they were received unofficially by the French foreign minister, Charles Maurice de Talleyrand-Périgord, but then weeks passed with no word on when an audience with the Directory might be expected. During this time, through the contrivance of Talleyrand's friend Mme. de Villette, the Americans were approached by three agents of the foreign minister—Jean Conrad Hottinguer, a Swiss; a Mr. Bellamy, an American financier living in Hamburg; and Lucien Hauteval, also a Swiss (designated mysteriously as X, Y, and Z, respectively, in President Adams' subsequent report to Congress). As a price for negotiations between the two governments, the French emissaries demanded a bribe of about \$250,000 (to be paid to Talleyrand), a large official loan from the United States, and an apology for certain references to France in a recent

speech by Adams. Although bribery was not an unknown adjunct to the diplomacy of that day—particularly where Talleyrand was concerned—the Americans found the proposition totally unacceptable. (Pinckney's supposed retort, "Millions for defense, sir, but not one cent for tribute," is the origin of the famed shibboleth, although the words were not his. Pinckney did, however, exclaim at one point in the conversations: "No! No! Not a sixpence!")

In a carefully reasoned statement covering the American position, presented by the mission on Jan. 17, 1798, the United States offered to extend to France the same privileges granted to Britain under the terms of Jay's Treaty. At the same time it demanded reparations for the spoliation of American shipping. After a lengthy delay, Talleyrand countered with an offensive proposal to treat with Gerry alone, characterizing the other ministers as unfriendly to France. This latest indignity exhausted the Americans' patience. Outraged by Talleyrand's conduct, Marshall and Pinckney left Paris—the former sailing to a hero's welcome in the United States, the latter going to the south of France with an ailing daughter—but Gerry, naively thinking that his presence in the capital would serve to forestall a French declaration of war, remained in Paris but undertook no further negotiations with the French.

President Adams, on March 19, submitted a report to Congress on the unsuccessful negotiations, and two weeks later made public the commission's report. The details of the affair stung the American public to a high degree of indignation, and there was clamor—especially among the Federalists—for an immediate declaration of war. Congress took steps in the summer of 1798 to respond to the French effrontery—authorizing the capture of French armed ships, terminating all commercial dealings with France, abrogating the alliance of 1778, and fortifying the nation's defenses. George Washington was summoned from retirement to take command of the American Army.

Martial fervor swept the young republic, and events might have proceeded toward a tragic climax had not Adams courageously resisted public opinion and labored for a peaceful settlement. To the utter chagrin of his own party, which was reaping rich political dividends from the anti-French sentiment, and in the realization that any conciliatory gesture toward France undoubtedly would injure his political future, the Federalist president announced the appointment of William Vans Murray as minister to France. The way had been prepared for renewed contacts when Talleyrand let it be known that he would look favorably on the assignment of a new envoy. Under Federalist promptings, however, Adams agreed to entrust the venture to a three-man commission, including Murray. The Americans were received with courtesy by Napoleon, and the ensuing negotiations culminated in the Treaty of Mortefontaine (or Convention of 1800), which formally released the United States from the alliance and ameliorated strained feelings on both sides of the Atlantic. Thus ended the so-called Quasi War between the two countries.

Military action during the two-year dispute was confined to naval engagements, with both sides preying on each other's shipping. The small but able United States Navy captured about 85 armed vessels, mostly French privateers operating in Caribbean waters.

Y	EARLY NORTH SEMITIC	PHOENICIAN	EARLY HEBREW (GEZER)	EARLY GREEK	CLASSICAL GREEK	ETRUSCAN		EARLY LATIN	CLASSICAL LATIN
	𐤅	𐤆	𐤅𐤆	ι	ι	Early	Classical	ΙΥ	ΙΥ (i)
	CURSIVE MAJUSCULE (ROMAN)	CURSIVE MINUSCULE (ROMAN)						VENETIAN MINUSCULE (ITALIC)	MODERN ROMAN
	Y	y						y	y

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The development of the letter Y is illustrated in the chart above, beginning with the early North Semitic letter. The evolution of the majuscule (capital) is shown at top; that of the minuscule (lowercase) at bottom.

Y, wi, the 25th letter of the English alphabet, in origin identical with *u*, *v*, and *w*, notwithstanding the great variety of sounds that it designates. Other symbols have also been used for the different values of *y*, notably *z*, a variety of *g* (as in Old English *zeaf*, "he gave"; *zeoc*, "yoke"). In early printed texts *y* was taken as the closest type form for the Old English thorn, *þ* (*th*), which led to the mistaken notion that *ye* is an archaic form of *the*, and to a corresponding mispronunciation. *Y* may also go altogether unwritten, as in *union*.

One explanation for the English name of the letter is that, since *Y* looks like *u* (in the form *V*) set over *i*, the name *ui* or *wi* was invented to describe this apparent construction. The modern French name, *i grec* (*Greek i*), indicates clearly the actual source of the symbol, at least in its vocalic value.

After the Greek *v* had become *ū*, it was borrowed into Latin (in the 1st century B.C.) as distinct from *u*, in words of Greek origin (*Pyrrhus*) and even in words, Greek or not, in which *i* was proper (*hystoria*, *Ytalia*). So in English we have *y* both in genuine Greek words and in words supposed to be such (*rhyme*, O.E. *rim*).

In the Greek alphabet, *v* stands after *τ*, and before the added signs *ϕ*, *χ*, *ψ*, which stamps it as a novelty. Moreover, it had properly a vocalic value only; English consonantal *y* is of different origin, namely the palatal *g* or consonantal *i*; since the symbol *z* (pronounced like *y* in *you*) survived in northern England and Scotland longer than in the south, it came in Scottish practice of the 16th century to be confused with *z*. Hence the form *Menzies* (pronounced *Mengies*), although a spelling pronunciation has survived in some cases (*MacKenzie*).

The *y* of Old English which arises from *u* by umlaut, as in *mys*, the plural of *mus*, is now written *i* (*mice*). In such an archaism as *yclept*; the *y* is nothing more than the prefix *ge-* (German *ge-*) substituted for the *t-* into which it had passed in Middle English (*icleped*, O.E. *gecleopod*).

As an abbreviation, *y* is used in algebra for the second unknown quantity; and more generally for *y*-shaped objects (*Y-cartilage*; *Y-branch*).

JOSHUA WHATMOUGH

Further Reading: See the bibliography for ALPHABET.

**YAAN**, ya'än', municipality and special district, China, in west-central Szechwan Province. Situated on the Chengtu-Kunming railroad, 60 miles east of Kangting, Yaan is an important tea-processing and automobile-repair center and is noted for its exports of bamboo shoots, foodstuffs, and animal products. Pop. (1967) 55,200.

**YABLONOVY MOUNTAINS**, yi-blā-nō'vi (formerly called YABLONOV MOUNTAINS), mountain range, USSR, in eastern Siberia, extending from southwest to northeast, approximately 625 miles long, 12½ to 75 miles wide, and 5,250 to 5,900 feet high. From the city of Kyakhta, in the Buryat Autonomous SSR, on the border of the Mongolian People's Republic, the mountains run east of Lake Baikal along the eastern border of the Buryat ASSR and the western border of Chita Oblast into Amur Oblast, where they merge into other ranges at the Olekma River. The Yablonovy Mountains are the watershed between rivers flowing into the Arctic and Pacific oceans. Except for the rocky highest peaks, the range is covered with forests. Tungsten, molybdenum, and gold are mined.

ELLSWORTH RAYMOND

**YACHTS AND YACHTING**, yōts, yōt'ing. In the broadest sense, a yacht is any boat, vessel, or ship privately owned and used for pleasure, although the term is only occasionally applied to small undecked sail, motor, and rowing boats. Yachts may range from such small open craft to sumptuous sailing and diesel-engine-powered vessels 200 feet long; since World War II, however, pleasure vessels more than 100 feet in length have been few. The term includes partly decked sail- or power-boats for day sailing and racing; cabin cruisers propelled by sail, power, or both (the last called auxiliaries); and big sea-going vessels. Yachting, likewise, is a term that covers a multitude of activities: afternoon sailing, small-boat racing, leisurely coastwise cruising in sail or power craft, round-the-world voyages, international racing, entertaining aboard luxury vessels, and many more.

**History.** The once common conception of yachting as exclusively a millionaire's sport was never wholly accurate, at least in American history. Even colonial records list boats used for pleasure by men of modest means. Now, with the increase of income and leisure time among more people, yachting has become a popular pastime, enjoyed by millions in a wide range of financial brackets. It is widespread in the United States and in many other countries, particularly Canada, Britain, western Europe, Brazil, Argentina, Australia, and New Zealand.

The word *yacht* came into English through Dutch *yaght* (now *jacht*) from the earlier Low German *jacht* or *jachtschiff*, meaning literally a hunting ship, used by pirates (or against them). The sport of yachting, however, may be traced back to Egyptian, Greek, and Roman days, when

royalty maintained "pleasure barges." Charles II introduced the pastime into England in 1660 when he returned from exile in Holland. The earliest recorded yacht club (1720) was the Water Club of Cork Harbor, Ireland.

In America, an engraving of New York Harbor dated 1717 identifies "Col. Morris' yacht *Fancy*," and history indicates that many craft were privately owned for pleasure at that time. Early short-lived yacht clubs were the Knickerbocker Boat Club in New York City in 1811 and the Boston Yacht Club in 1835. The oldest surviving organization in the United States is the New York Yacht Club, founded in 1844, which held its first cruise that year and its first regatta in 1845; except for interruptions by war, these events have been held annually ever since. Today there are probably 1,500 clubs in the United States devoted to the sport of yachting, many of them on inland rivers and artificial lakes where yachting was never thought of until the 1930's and 1940's. Some are elaborate and expensive, but many are simple and unpretentious, serving the small-boat owner of modest means. In many harbors, marinas provide berthing facilities where sailboats and powerboats can be moored safely and conveniently in limited areas.

#### DESIGN AND OPERATION

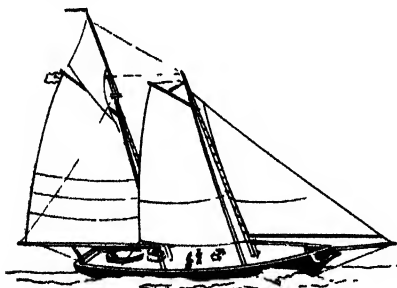
**Design and Construction.**—Early yachts were modeled after commercial, naval, and fishing vessels of their time and place and built by the same men, often to lines taken from small models whittled and scraped to shape from a block of pine. The modern practice of designing a yacht on paper according to scientific principles began,

in the United States, after the Civil War. Now naval architects draft and calculate each line and element of a yacht before building is begun.

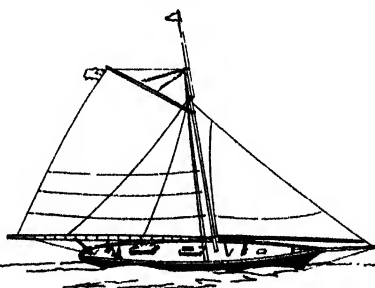
Concurrent with scientific designing came the gradual evolution of distinct yacht types, although the influence of commercial types is still evident. There is no single "yacht type," but there are many types of yachts, each designed for the waters where it is to be sailed, the use to which it will be put, and the particular requirements of the owner.

All yacht design is a compromise. Features that make for high speed, for instance, generally sacrifice some seaworthiness, comfort, and ease of handling. The ideal boat for a shorthanded cruise around the world would make a poor showing in a race, and one suitable for coastwise cruising differs from both a deepwater craft and a racer. Strict economy in first cost, maintenance, and operation is incompatible with the full attainment of other desirable qualities. A boat appropriate for shallow, protected waters may perform badly in a rough ocean or large lake, and vice versa. This principle is true of power-driven as well as sailing boats. A boat buyer should decide when, where, and how he is going to use his boat, then get one that fits the job.

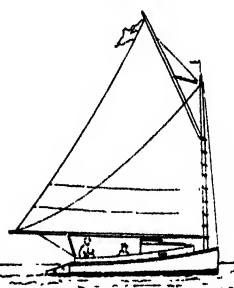
For centuries, standard yacht construction was of the wooden-frame-and-plank type. Iron and steel were used for large yachts in the later 19th century and are used now in some 30- and 40-footers. In these sizes iron and steel compete with aluminum, which is used increasingly for smaller craft. Special aluminum alloys must be employed to prevent saltwater corrosion. To some extent, plywood has replaced conventional wooden plank



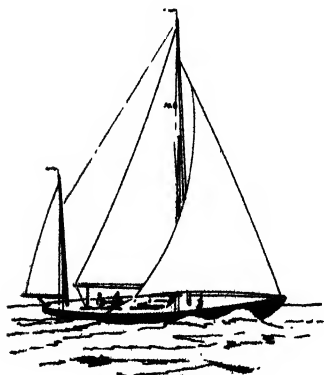
The famous schooner *America*



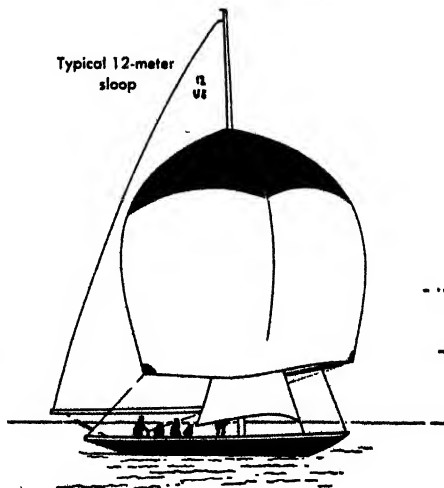
The sloop *Maria*



Cape Cod cat boat



*Baruna*—a modern yawl



Typical 12-meter sloop



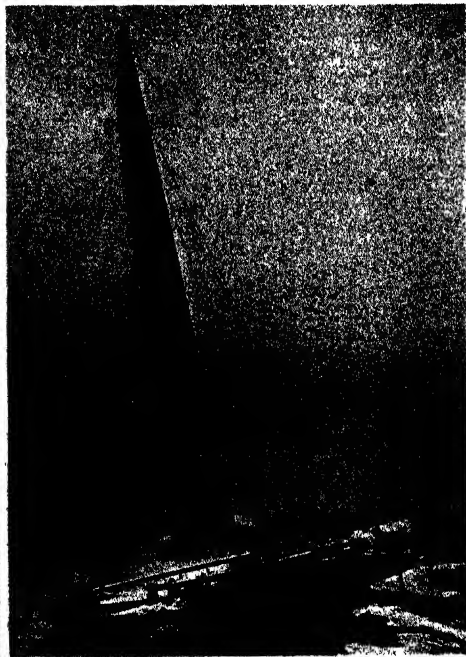
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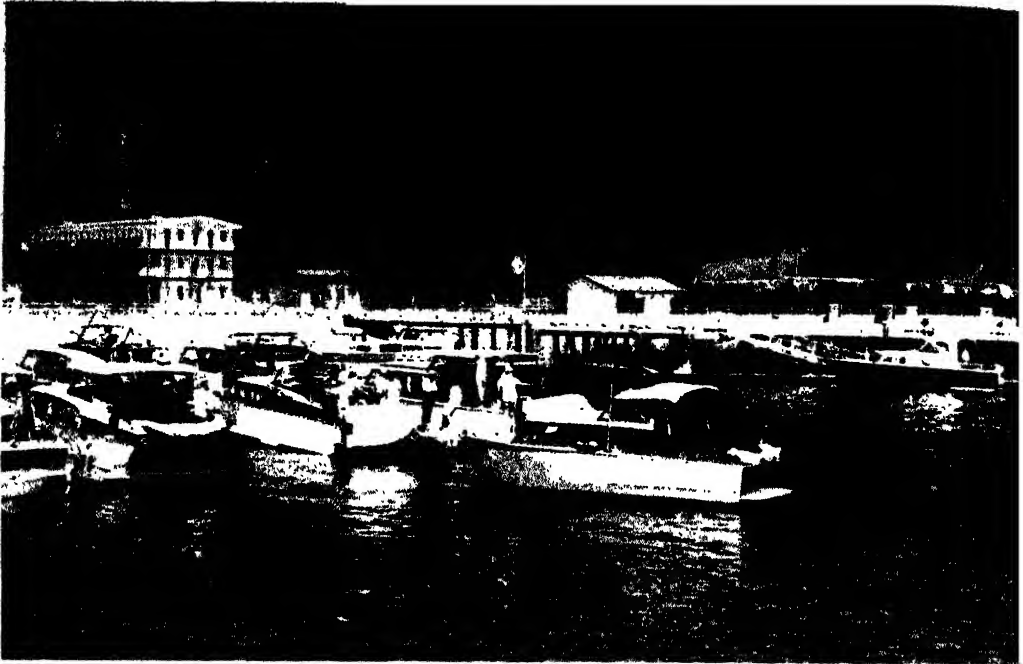


## YACHTS AND YACHTING

Above: On Long Island Sound, as elsewhere in the yachting world, Star class boats, which are about 22 feet in maximum length, engage in exciting races. Right: Powered cabin cruisers are popular pleasure craft. Below: The Weatherly, winner of the 1962 America's Cup race. Below right: Double-hulled catamarans, or "cats," are new in the yachting world, and are capable of great speed.

(Top) P. Gendreau; (others) Morris Rosenfeld





PETER MACKAY/MONKMEYER

Family day-boating and cruising on rivers, lakes, and bays are enjoyed by many in a variety of power boats.

ing for small craft in recent decades. The greatest growth since the mid-1940's has been in the building of molded, fiber-glass-reinforced plastic boats. This is now very popular in small craft and increasingly so in those up to about 40 feet long, sail and power. It has advantages in maintenance and is economically practical for building large numbers of identical small boats. In large craft built in very small numbers, prices become virtually prohibitive due to the high cost of making the molds.

Yacht building in the United States, traditionally carried on in hundreds of small plants around the country, currently shows a trend toward fewer and larger concerns. While once virtually every pleasure craft was individually designed and built, today nearly all small craft and many sail and power yachts up to 50 feet long and more are either stock or standardized in design and build for purely economic reasons.

**Power Yachts.** Steam power was applied to yachts during the latter part of the 19th century, and in the early 1900's many wealthy men owned luxurious steam yachts, used more often for entertaining and ostentatious display than for satisfying any real taste for the sea. The naphtha launch had a brief vogue in the late 19th century, and early in the 20th century the internal combustion gasoline engine began to be fitted to pleasure craft, both as the prime motive power and as auxiliary power in sailing yachts. The refinement and increasing economy of gasoline engines rapidly brought power yachting within the reach of those of modest means.

A major factor in more recent years has been the outboard motor, a self-contained power plant hung on the stern of a boat. Originally a low-powered "substitute for a pair of oars," outboards are now built in units of as much as 100 horsepower.

See also **MOTORBOATS.**

**Yacht Speeds.** The speed of yachts and, indeed, of all vessels involves the type of hull. There are two types: displacement hulls and planing hulls. The displacement hull moves through the water, pushing aside a weight of water equal to its own. Two factors, skin friction and wave making, limit the speed. The practical limit of speed of a vessel of this type is called the speed-length ratio, the speed being relative to the square root of the effective waterline length. A 36-foot sloop sailing at 7.8 knots<sup>1</sup>, a 100-foot fishing schooner making 13 knots, and a 900-foot ocean liner smashing along at 39 knots are all maintaining a speed-length ratio of 1.3 to 1. For such vessels to increase these speeds even by small fractions takes an enormous increase of power. The sailing vessel would be likely to lose masts or blow out sails in the attempt, and the steamer would use up a disproportionate amount of fuel for every fraction of a knot of increase.

The speed-length ratio of 1.3 to 1 is considered a good performance. Some vessels never exceed a 1 to 1 ratio; a few, designed primarily for speed, may reach 1.4 to 1 or possibly 1.5 to 1 under ideal conditions. To exceed that, however, a hull is no longer acting entirely as a displacement hull, but is to some extent "planing."

Records made by sailing yachts with displacement hulls include the transatlantic record of 12 days 4 hours 1 minute from Sandy Hook lightship to The Lizard on England's south coast, an average of 10.3 knots, set in 1905 by the 134-foot waterline schooner *Atlantic*; the 30-mile triangular race record of 2 hours 47 minutes 59 seconds, at 10.7 knots (fastest leg, 13.3 knots) by the 84-foot waterline sloop *Yankee* in a 1930 America's Cup trial; and the record for the 635-mile Newport-Bermuda race of 70 hours 11 minutes 37

<sup>1</sup> 1 knot = 1 nautical mile (approximately 1 1/4 statute miles) per hour.



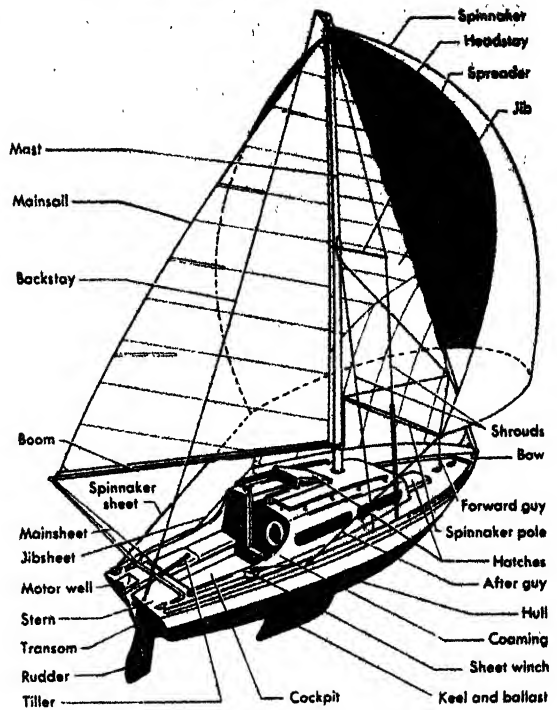
seconds, a 9-knot average, by the 51-foot water-line yawl *Bolero* in 1956.

Planing (and semiplaning) boats exceed these speeds by lifting partly out of the water and skipping along the surface. Ability to do this depends on the design of the boat's bottom, lightness of weight in proportion to size and power, and application of high power (motor or wind). The water must be fairly smooth, since a boat planing in a heavy sea is likely to bounce and turn over or break up.

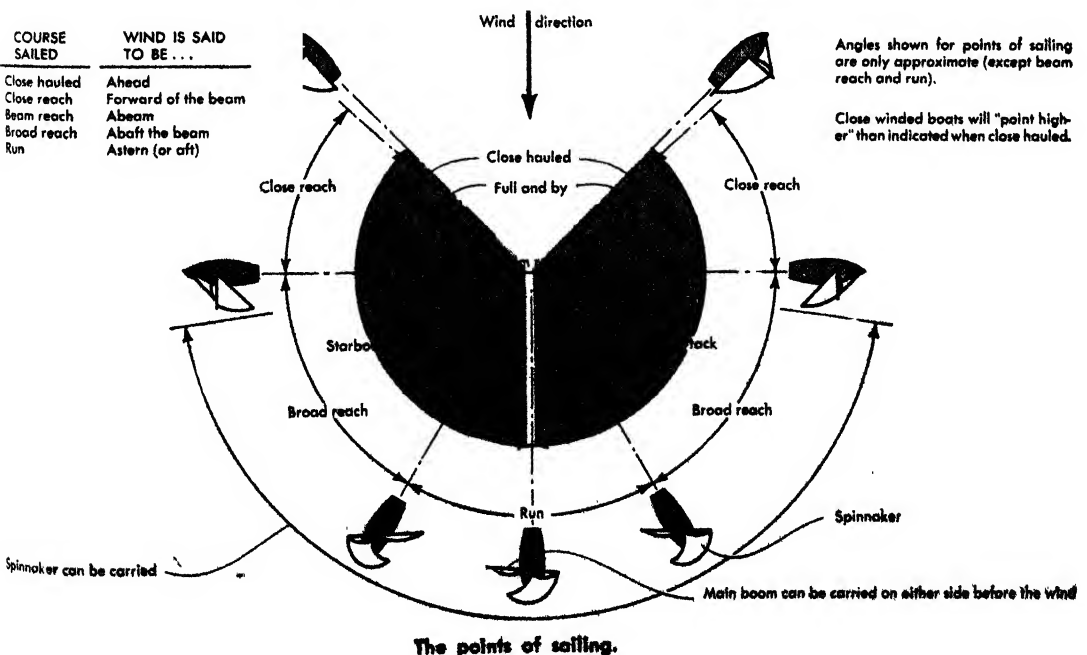
Motorboats of the hydroplane type, riding on literally a few square inches of their bottoms, have made speeds as high as 240 miles per hour, using engines of more than 3,000 horsepower in hulls only about 30 feet long. Sailboats cannot draw on any such power, since winds strong enough to produce it would blow away their sails and rigging; but they can exceed the speed-length ratio. Traditional planing sailboats are the inland lakes scows—light, wide, flat hulls with big sail plans—which in very strong winds have been clocked at around 25 mph. More conventional but specialized small planing boats like 14-foot dinghies, Flying Dutchmen, 5-0-5 Class boats, and numerous others also reach high speeds when conditions are just right. Catamarans, modern versions of a 1,000-year-old type of craft floating on two long, slim, parallel hulls, although not strictly planing boats, are free from some of the limitations of wave making and friction affecting more conventional hulls, and can sail very fast. A 40-foot seagoing catamaran is reported to have been timed at 28 mph.

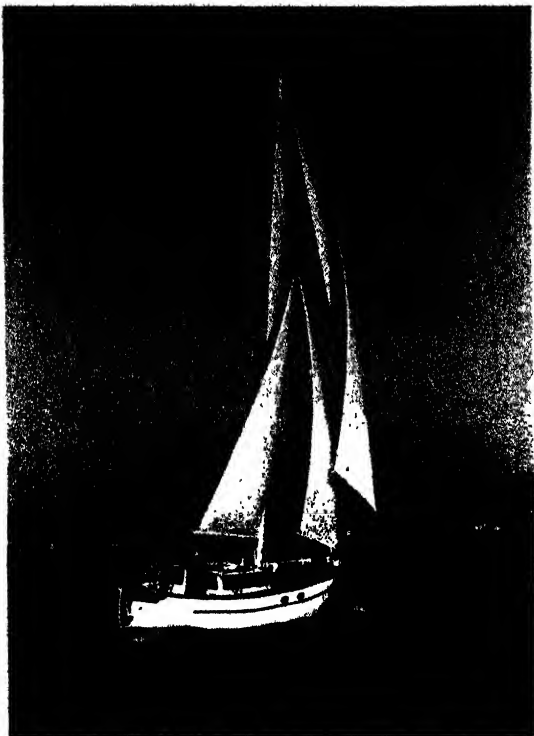
**Principles of Sailing.** Sailing, with its infinite variety of boats and conditions, is an art that may take a lifetime to perfect, but its basic principles are so simple that a 10-year-old can learn in a few hours to sail a small, simple boat safely and adequately in good weather and protected water. Forward motion of a sailboat is induced by wind blowing on the sails, which must be properly trimmed to utilize it. Trimming is done with a rope called a sheet, which pulls the sail toward the middle of the boat.

Basic features of a sailboat.



In *running*—with the wind coming from dead astern or nearly so—sails are slacked out nearly at right angles to the keel (axis) of the boat. In *reaching*—with the wind coming over the quarter (broad reach) or broadside (beam reach) or from not more than 40° forward of the beam (close reach)—the sails are trimmed in just enough so that they do not shake and spill wind, but no closer.





T. M. GREEN

This double-ended cruising sailboat is designed for long voyages and living aboard at the expense of speed.

*Beating* to windward is harder. A boat can sail to a point in the exact direction from which the wind is blowing by making a series of zigzag *tacks*. With sails trimmed as near amidships as they can be, a smart boat will sail on a course about 45° off the wind. Very close-winded boats under ideal conditions sometimes sail within 40°; many will not sail closer than 50° or 55°. To reach a point to the north when the wind is blowing from the north, one should steer northeast for a while with flat-trimmed sails, then come about and steer northwest, continuing thus on alternating tacks until one reaches the destination.

To change from one tack to the other, one swings the boat into the wind's eye and past it until sails are full on the other tack. Jibing, or changing tacks by steering away from the wind until one brings it on the other side of the sail, can be dangerous and requires expert steering and sail handling.

What keeps a boat from simply blowing sideways before the wind is her lateral plane. This is the area of the hull below water as viewed in profile; it is usually increased by adding to the hull proper a keel extending below it, or a centerboard, or both. The centerboard, a flat plate of wood or metal, is pulled up inside the hull when the boat is running before the wind or is at anchor. It may be partly lowered for reaching and is fully lowered when working to windward. All boats, when beating, make some leeway (sideslip), but good ones make only a few degrees from the course steered.

The afterpart of the lateral plane includes the rudder with which the boat is steered. This is pivoted at its forward end and controlled by a tiller (straight stick) or a steering wheel and

gear inside the boat. As the tiller end is pulled to the right, the afterpart of the rudder swings left, and the bow turns left (to port). For a right or starboard turn, the tiller end is pulled left, and the afterpart of the rudder swings right.

Ballast (heavy weight in the keel or inside the hull) acts as a pendulum to keep the boat upright against the heeling (tipping) force of the wind. When the wind blows hard enough to heel the boat dangerously, sails are reduced in area by reefing, or some sails may be dropped altogether. In very hard winds, small, strong storm sails are substituted for the working sails. In very light airs, many boats set large, lightweight balloon-type sails. A boat when sailing is stopped by steering her directly into the wind (luffing) or by slacking sheets until the sails shake and spill the wind.

#### RACING (SAIL)

**Racing Classes.** There are hundreds of sailboat racing classes of all sorts and sizes. Some are local and involve only half a dozen to a few score boats; others are national and international and number up to several thousand. They may be divided broadly into three groups: one-design classes, rating classes, and handicap classes.

In *one-design* classes, boats are as nearly alike in hull, rig, and equipment as they can be made. Racing success depends on the skill of the skipper and crew in maintaining the boat in top condition and sailing her well.

*Rating* classes compete without time allowance. The boats are not identical but must not exceed a certain figure when measured under one of a variety of mathematical rating formulas. These formulas take into consideration from one to a score of factors affecting a boat's speed, such as length, sail area, weight, type of rig, beam, draft, ballast, wetted surface, and certain structural features. One of the simplest is the old Seawanhaka Rule: "Length plus Square Root of Sail Area, divided by 2, equals Rating." Under this, a boat 30 feet long with 400 feet of sail would rate 25 feet. Most rules have grown extremely complicated (one fills a 20-page booklet) mainly to prevent designers from producing undesirable "freak" boats that rate low but may be unseaworthy, overly fast but expensive to build, or subject to breakdown in fresh winds. Two widely used rules developed early in the 20th century are the Universal Rule, used principally in the United States, and the International Rule developed in Europe. Universal Rule ratings are expressed in feet, as a 25-foot rating, also called Class Q; international ratings are expressed in meters, as 12-Meter and 6-Meter. The International Rule has largely superseded the Universal Rule even in the United States.

*Handicap* racing is practiced where dissimilar boats race together in one group, as in a club regatta, and in virtually all long-distance and ocean races. Here each boat's measurements are taken and her rating calculated under a rule such as described before. For each tenth of a foot of rating, a standard time allowance table gives the second-per-mile handicap that the boat would receive from an arbitrarily selected scratch boat. This figure is multiplied by the length in miles of the course to be sailed, to produce the time allowance that is deducted from the actual elapsed time of each boat in the race. The result is the corrected time, on which most prizes are awarded. For cruising-boat races, the measurement rules

## AMERICA'S CUP RACES

Year	Winner	Loser	Races
1851	America (U.S.)	Royal Yacht Squadron (England)	1-0
1870	Magic (U.S.)	Cambria (England)	1-0
1871	Columbia (U.S.)	Livania (England)	4-1
1876	Madeline (U.S.)	Countess of Dufferin (Canada)	2-0
1881	Mischief (U.S.)	Atlanta (Canada)	2-0
1885	Puritan (U.S.)	Genesta (England)	2-0
1886	Mayflower (U.S.)	Galatea (England)	2-0
1887	Volunteer (U.S.)	Thistle (Scotland)	2-0
1893	Vigilant (U.S.)	Valkyrie II (England)	3-0
1895	Defender (U.S.)	Valkyrie III (England)	3-0
1899	Columbia (U.S.)	Shamrock (England)	3-0
1901	Columbia (U.S.)	Shamrock II (England)	3-0
1903	Reliance (U.S.)	Shamrock III (England)	3-0
1920	Resolute (U.S.)	Shamrock IV (England)	3-2
1930	Enterprise (U.S.)	Shamrock V (England)	4-0
1934	Rainbow (U.S.)	Endeavour (England)	4-2
1937	Ranger (U.S.)	Endeavour II (England)	4-0
1958	Columbia (U.S.)	Sceptre (England)	4-0
1962	Weatherly (U.S.)	Gretel (Australia)	4-1
1964	Constellation (U.S.)	Sovereign (England)	4-0
1967	Intrepid (U.S.)	Dame Pattie (Australia)	4-0
1970	Intrepid (U.S.)	Gretel II (Australia)	4-1
1974	Courageous (U.S.)	Southern Cross (Austral.)	4-0
1977	Courageous (U.S.)	Australia (Australia)	4-0
1980	Freedom (U.S.)	Australia (Australia)	4-1
1983	Australia II (Australia)	Liberty (U.S.)	4-3
1987	Stars & Stripes (U.S.)	Kookaburra III (Australia)	4-0
	Stars & Stripes (U.S.)	New Zealand (N. Zealand)	2-0

most commonly used are those of the Cruising Club of America, the British Royal Ocean Racing Club, and the Storm Trysail Club (United States). The rules are intended to give each boat, as far as possible, an even chance of victory when many boats of different size and design are racing. The control of freak boats, by penalizing them with high ratings, is a secondary but still important factor.

**Racing Rules.** The rules that govern fair sailboat racing and specify which boats have the right of way in various tactical situations at close quarters are virtually standardized everywhere. Originally based on the International Rules of the Road at Sea for commercial sailing vessels, they have become much more detailed and elaborate. The Rules of the Road are designed to keep ships at a safe distance from each other, while the racing rules apply to boats that are necessarily sailing close together. Factors in determining the right of way include which boat is on port and which on starboard tack (a boat is on starboard tack when the wind comes over her starboard or right side and the sail is therefore on the port or left side, and vice versa); which boat is overtaking another; which is to windward and which to leeward; and the presence or absence of obstructions such as shoals, buoys, and other boats. Variations and definitions clarify these rules according to circumstances. In general, port-tack, overtaking, and windward boats are required to keep clear, and room has to be given at obstructions and course markers.

Since no umpire or referee follows the ordinary sailing race to enforce rules, enforcement depends on the voluntary withdrawal from the race of a boat that has broken a rule, or a protest may be made against her by the skipper of another boat. Both sides are heard and a decision made by the race committee after the contest.

**International Yacht Racing.** The America's Cup has been for over a century the top prize of international yacht racing. The schooner yacht *America*, built in New York City in 1851 for a group of members of the New York Yacht Club,



The U. S. 12-meter yacht *Freedom* takes the lead over the challenger *Australia* in the 1980 America's Cup races.

was 101 feet long, a typical American schooner of the fast seaworthy type then used by New York pilots. She was sailed to England, where she won a trophy of the Royal Yacht Squadron called the Hundred-Guinea Cup in a race around the Isle of Wight against 17 British yachts. During the Civil War the *America* was used by the Confederates as a blockade runner and then was captured and used as a Federal naval dispatch boat. Later she became a yacht again and in 1921 was presented to the United States Naval Academy at Annapolis, Md., where she was broken up in 1946.

The Hundred-Guinea Cup became known as the America's Cup after it was decided to the New York Yacht Club by the yacht's original owners in 1857 to be an international challenge trophy. A clause in the deed of gift, inserted to ensure that only really seaworthy yachts would compete for the cup, required a challenger to cross the ocean under sail on her own bottom. The cup has always been raced for by yachts of the largest active racing classes in point of size. Since 1870 attempts to take the America's Cup were made by Canada, Scotland, Australia, and England. The New York Yacht Club defended it successfully until 1983.

In 1958, after a 21-year lapse of races, the longest in the history of the trophy, the deed of gift was altered, permitting somewhat smaller yachts to race and dropping the requirement of sailing across the ocean.

Three U.S. yachts twice defended the cup successfully: *Columbia* (1899, 1901), *Intrepid* (1967, 1970), and *Courageous* (1974, 1977). The British lost challenges in 1958 and 1974. After losing its first six challenges Australia, represented by *Australia II*, defeated the U.S. *Liberty* in 1983. The *Stars & Stripes*, sponsored by the San Diego Yacht Club, regained the cup in 1987.

In the following year New Zealand issued an unorthodox challenge to the United States for another America's Cup race three years sooner than was usual. The San Diego Yacht Club accepted the challenge. The challenger's yacht was the *New Zealand*, a 132-foot monohull; the U.S. entry was the *Stars & Stripes*, a 60-foot multihull catamaran. The U.S. yacht easily won the first two of the best of three scheduled races in September 1988. New Zealand went to court, charging that San Diego's use of the catamaran created a mismatch and was illegal inasmuch as a multihull is much faster than a monohull. After moving through lower courts, the case was finally disposed of in favor of the San Diego club, which was awarded the trophy by the New York court of appeals.

The America's Cup is only one of many international sailing events. International competition in the Olympic Games, which began in 1900, has fostered keen rivalry. Five classes of boats have been raced: 5.5-Meter sloops, keelboats of open design with three-man crews; Dragons, one-design keelboats with three-man crews; Stars, keelboats with two-man crews; Flying Dutchmen, planing centerboard boats with two-man crews; and Finn Monotypes, one-man centerboarders.

Besides the America's Cup, there are many challenge trophies, originating in various nations, which are raced for internationally, such as the Seawanhaka Cup, British-American Cup, Scandinavian Gold Cup, One-Ton Cup, and Coppa d'Italia. For many years those named were competed for in the 6-Meter Class, but this has been largely superseded by the 5.5-Meter, which is a smaller and less costly type of sloop.

A number of large one-design classes also hold international championships. Some are limited to one or two countries where these classes are popular; others are truly worldwide in distribution, like the Star Class, Snipe Class (16-foot centerboard sloops), Flying Dutchman, and others. These are generally annual or biennial events.

**Ocean Racing.** Although the first transatlantic yacht race was sailed in December 1866, this branch of the sport began to attain its present popularity early in the 20th century among owners of relatively small but seaworthy cruising yachts. Among the best-known regularly scheduled ocean races are the one from the east coast of the United States to Bermuda and the one from the west coast to Honolulu, both of which date from 1906; the British Fastnet race from southern England to the Irish coast and back; and races from Sydney, Australia, to Hobart, Tasmania; Buenos Aires, Argentina, to Rio de Janeiro, Brazil; San Diego, Calif., to Acapulco, Mexico; Los Angeles, Calif., to Ensenada, Mexico; and Victoria, British Columbia, offshore to Swiftsure Bank and return. The Southern Ocean Racing Circuit includes five winter contests in waters between Florida and the Bahamas.

Ocean racing led to the development of yachts that are slightly less speedy than the ex-

treme racing types but offer excellent accommodations and seaworthiness in all weathers. In World War II many of these ocean-racing yachts were used by the U.S. Coast Guard on submarine patrol along the coast. Skippers and navigators and most of the crews on ocean-racing yachts usually are amateurs.

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WILLIAM H. TAYLOR

Former Managing Editor of "Yachting"

**Yafa**, ya'fā (Ar. YAFI'), a landlocked tribal area and tribal confederation in the Western Aden Protectorate (WAP), Arabian Peninsula, bounded on the north by Yemen and elsewhere by other WAP sultanates: Audhali ('Awdhali) on the east; Fadli (Fadli), south and southeast; Amiri, west. The terrain is elevated, between 1,000 and 2,000 feet near the coast, rising gradually from about 3,000 feet to peaks over 8,000 feet farther inland. Much of the country is tangled mountains and ravines. It is hot in summer and, in the mountains, cold in winter. In the higher areas rainfall is about 20 inches a year. The people are Arabic-speaking Muslims.

The chief grain crops are sorghums, wheat, and barley. Dates grow up to an elevation of 4,000 feet, and a variety of fruits and vegetables are raised. In the western part of Lower Yafa coffee is an important crop.

The area's industry and communications are primitive. Camels and donkeys are the chief means of transportation.

Yafa is divided into two sultanates: Lower Yafa (capital Al Qara; al-Qārah), and Upper Yafa (capital Mahjaba; Mahjabah). There are also minor sheikhdoms within Upper Yafa. The law practiced in Yafa is a combination of Islamic and tribal law. Lower Yafa is a member of the Federation of Arab Amirs of the South (formed in 1959).

Previously under Yemen, the Yafa, like other Aden Protectorate peoples, were gradually brought under British sway following the conquest (1839) of the town of Aden. A British protectorate was established over Lower Yafa in 1895, and a treaty signed with Upper Yafa in 1903. Traditionally the British did not supervise internal protectorate affairs, but in the 1930's they began to bind the various small states by "advisory treaties" (Lower Yafa, 1944-1945) providing for a resident adviser, whose advice to the ruler was obligatory. Yafa tribes have considerable importance in southern Arabia because they furnish mercenaries and the dynasties of several other important south Arabian sultanates (Lahj, or Lahj; Mukalla) are of Yafa origin.

R. BAYLY WINDER *Princeton University*

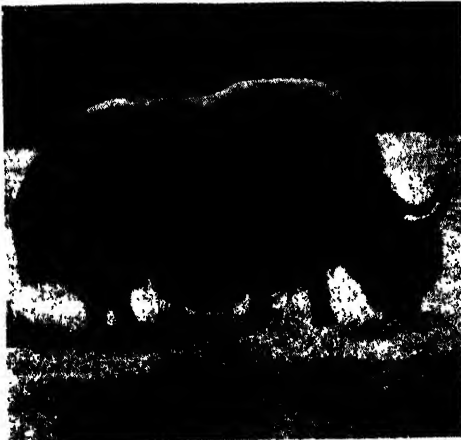
**Yahi Indians.** See YANA INDIANS.

**YAHOO**, yā'hōō, in the 4th voyage of Jonathan Swift's famous satire *Gulliver's Travels* (1726), the name given to a race of brutes, described as having human forms and degraded natures. They were subject to the Houyhnhnms, or horses endowed with human reason. Hence, the term has come to be applied to a rough, low, boorish, or uneducated person. See also GULLIVER'S TRAVELS.

**YAJUR VEDA.** See VEDIC LITERATURE.

**YAK**, yāk, an animal (*Bos grunniens*) of the Bovidae family, distributed in the high bleak plateaus and mountains of Central Asia. It is found in Tibet, Kansu (northwest China), and the Chang Chenmo Valley of Ladakh (eastern Kashmir). It ranges from the lower valleys to 20,000-foot levels, feeding on coarse grasses. The wild yak moves in winter from the snow-covered slopes to the valleys.

Wild yaks are black, shaggy animals about the size of common oxen, with a shoulder height of about 5 feet 2 inches. They have enormously long hair which continues down the tail, giving it a bushy appearance. Their horns come straight across and then curve upward, and may measure 40 inches from tip to tip. Domestic yaks are smaller (shoulder height about 4 feet 3 inches), consisting of half-breeds—male wild yaks crossed with female Zebus (Indian humped cattle)—mainly black and white in color. The yak is exceptionally well adapted to endurance of cold and shows superb stamina, which makes it an excellent animal for carrying people and other burdens. Its numbers are decreasing, although it once was as abundant as the American bison. Old bulls wander about in twos or threes, but females and calves herd together for protection.



A. W. Ambler from National Audubon Society  
Yak (*Bos grunniens*).

The domesticated forms, although used principally for transportation, are valued also for their meat. This is of excellent quality, and calf meat is especially tasty. The cows provide quantities of rich milk. The Tibetans also extract good yields of butter, which they use to flavor their tea or to burn in religious shrines. The long hair of the yak is made into ropes, while hides with hair are used as coverings for tents. The tails are sometimes dyed bright red

and sold as flyflappers in the cities of India.

ALFRED NOVAK,  
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**YAKIMA**, yāk'-mə, city, Washington, Yakima County seat, on the Yakima River, 100 miles southeast of Seattle. It is a commercial and industrial center for the irrigated Yakima Valley, which produces fruit (especially apples), grain, vegetables, sugar beets, hops, and livestock. The city manufactures lumber, flour, cider, clay products, and clothing, and has many packing plants. There is an airport.

Yakima Valley College is situated here, and the city has a museum and an art gallery. Other cultural institutions are the Yakima Valley Regional Library, the Little Theatre, and the Yakima Symphony. Points of interest in the vicinity include the Yakima Indian Reservation, historic Fort Simcoe (a relic of the Yakima Indian War of 1855-1858), the White Pass ski area, and fishing resorts. Fruit orchards in bloom attract visitors each spring. The United States Army Firing Center is an important training center for both desert and mountain warfare.

Yakima was founded in 1885. The first settlement was made in 1861 four miles to the southeast, but the town was moved to the present site when the Northern Pacific Railway built a station there. Until 1918 it was called North Yakima. The original settlement is now Union Gap. Yakima adopted a city manager-council government in 1960. Population: 54,827.

ELINOR EVANS.

**YAKIMA INDIANS** (from Indian *yaqimá*, run-away), an important division of the Shahaptian language family, formerly living on both sides of the Columbia River and along the northern branches of the Yakima and Wenatchee rivers in the State of Washington. Meriwether Lewis and William Clark, who encountered them in 1806, called them Cutsahnim and estimated their number at 1,200. In 1855 they ceded their homelands to the United States, accepting settlement upon a reservation in Washington, where they were to be established as a confederacy of 14 tribes under the leadership of Chief Kamaikan. The unruly impatience of white miners and settlers upset these plans, and the unnecessary and tragic Yakima War of 1855-1858 resulted. Eventually, some of the original tribes withdrew from settlement as an outgrowth of the bitterness of the war.

The term "Yakima" is used today to include loosely many tribes in the general area, particularly those living on the Yakima Reservation in Washington; it is therefore impossible to estimate tribal membership accurately. The culture of the whole group is much like that of all of the Shahaptian folk. Approximately 4,442 "Yakima" reside on the reservation in Washington.

FREDERICK J. DOCKSTADER.

**YAKIMA RIVER**, river, Washington, rising in the Cascade Range near Snoqualmie Pass. After a southeastward course of about 200 miles, it flows into the Columbia River at Richland, about 6 miles west of Pasco and Kennewick and 10 miles above the confluence of the Snake River. The Yakima flows through a coal-mining region, and its irrigated valley and the valleys



of its numerous short tributaries are among the most fertile in the state. The chief tributary is the Naches River, which joins the Yakima at the city of Yakima, the major city on its banks.

**YAKOVLEV**, yä'kof-lyaf, **Aleksandr Sergeyevich**, Soviet aircraft designer: b. Moscow, USSR, March 19, 1906. The son of a machinist, he was interested in aeronautics, particularly the building of aircraft engines, from early youth. While he was attending the Zhukovsky Air Force Engineering Academy in Moscow, from which he graduated in 1931, his attention turned to aircraft design. In 1936 his airplane won the "Round the USSR Tour"; this design proved so successful that it was used extensively for private flying clubs, and Yakovlev soon became recognized as one of the leading and most versatile Russian aircraft designers. He was commissioned by the government to build for the Air Ministry a high speed executive transport, known as the Yak-2, which was later redesigned as a dive bomber. In 1940 he was appointed deputy commissar (later deputy minister) of the aviation industry; he served in this capacity through World War II and after, until 1948. During the war he designed light bombers, fighters, and training airplanes. His later designs range from supersonic medium bombers and twin jet fighters to tandem rotor helicopters and a series of training and light general-purpose aircraft.

ELIZABETH B. BROWN.

**YAKUB KHAN**, yä-köob'khän', **Mohammed** (MUHAMMAD YA'QÜB KHÄN), amir of Afghanistan: b. 1849; d. Dehra Dun, India, Nov. 15, 1923. He was the eldest son of Amir Shir Ali. Disappointed because his father favored a younger son, Abdullah Jan, he revolted in 1870 and captured the city of Herat, but under British pressure was reconciled with Shir Ali and made governor of Herat. However, in 1873, after naming Abdullah heir apparent, Shir Ali seized Yakub Khan and imprisoned him. During his confinement (1874-1878), Afghanistan again became the focal point of Anglo-Russian rivalry in Central Asia. The amir's dealings with the Russians provoked a British ultimatum and, finally, a military advance (November 1878). The Russians declined to assist Shir Ali, who fled, and Yakub Khan was named regent, the heir apparent having died in August 1878.

Upon the death of Shir Ali in February 1879, Yakub became amir and carried on the fight (Second Afghan War) against the British until peace was restored in May. A British mission, specified in the treaty, went to Kabul, but in September the entire mission staff was killed by Afghan troops. Thereupon the British reentered Afghanistan and took Kabul. On Oct. 12, 1879, Yakub Khan abdicated and shortly afterward was sent to India, where he died.

NORMAN ITZKOWITZ.

**YAKUT AUTONOMOUS SOVIET SOCIALIST REPUBLIC**, yä-kööt', administrative division, USSR, in the Russian SFSR. A vast territory of 1,188,400 square miles, situated in northeastern Siberia, it has impenetrable forests and an exceptionally severe climate, and is very sparsely populated. It is bounded on the west by Krasnoyarsk Krai; on the north by the Arctic Ocean; on the east by Magadan Oblast and Khabarovsk Krai; on the south by Amur, Chita, and Irkutsk oblasts.

The republic is drained by the Olenek, Lena, Yana, Indigirka, and Kolyma rivers, all debouching into the Arctic Ocean. The central part is formed by the valleys of the Lena and its tributaries, the Vilyui and Aldan; the western tableland is crossed by low mountain ranges; in the east, high mountains form the Verkhoyansk and Stanovoi ranges. The city of Verkhoyansk has the world's greatest fluctuation in temperature, the recorded minimum being  $-94^{\circ}\text{F}$ . and the recorded maximum  $93^{\circ}\text{F}$ .; the average January temperature is  $-57^{\circ}\text{F}$ . and the July average  $60^{\circ}\text{F}$ . The northern tundra, vast marshy plains overgrown with mosses and lichens, is followed farther south by the "shrubby tundra," which in turn passes into dense conifer forests—the Siberian taiga.

The Yakuts, a Turkic branch of the Ural-Altaic peoples, constitute about 56 percent of the population; Russians, 36 percent; Tungus, Lamuts, Yukagirs, and Chukchi make up the rest. The Yakuts engage in hunting and trapping furbearing animals, in fishing, and in reindeer, cattle, and horse breeding. They obtain valuable mammoth ivory from frozen carcasses found in surprising quantities. Russian settlers introduced agriculture in the 19th century along the Lena and its tributaries, where stretches of fertile alluvial soil are frequent. Agriculture is collectivized, using modern techniques. The crops are barley, spring rye, wheat, potatoes, turnips, and cabbage. The principal towns are Yakutsk (q.v.), which is the capital, Verkhoyansk, Vilyuisk, Olekminsk, Tommot, and Sredne-Kolymsk.

The Yakut Republic has no railroads; Skovorodino, 500 miles south of Yakutsk by road or sledge tracks, is the nearest station on the Trans-Siberian Railroad. River transportation is possible for a short time in the summer; northbound shipping on the Lena makes connection with the northern sea route of the Arctic Ocean. Most important are the airlines connecting Yakutsk with Irkutsk (on the Trans-Siberian Railroad), Vilyuisk, Verkhoyansk, and Tiksi Bay on the Arctic Ocean, from where the air route continues to Archangel and Moscow. Gold is mined extensively in the Lena Basin; silver- and lead-bearing ores are worked; other mineral deposits, including rich reserves of coal, are hardly touched. Pop. (1961) 527,000.

NICOLAI RABENECK.

**YAKUTAT INDIANS**, yäk'a-tät, a subdivision of the Tlingit tribe of North American Indians, inhabiting an area around Yakutat Bay, Alaska. They are particularly known for their fine basketry. Their culture is wholly that of the other Tlingit tribes. See also TLINGIT.

FREDERICK J. DOCKSTADER.

**YAKUTSK**, yä-köotsk', city, USSR, capital of the Yakut Autonomous SSR (q.v.), a port on the Lena River, 3,000 miles east-northeast of Moscow. It is an important trading center for the republic's main exports: gold, ivory, and furs. The city's few industries (brickworks, sawmills, tanneries, ship repair yards) have only local significance. Most of the houses of the predominantly Russian population are one-story log cabins. Yakutsk has several technical schools, a teachers college, and a branch of the Academy of Sciences of the USSR. Pop. (1959) 74,000.

NICOLAI RABENECK.

**YALA**, yá-lá, province, Thailand, on the Malay Peninsula. It is bounded by the provinces of Songkhla to the northwest, Pattani to the north, and Narathiwat to the east and by the Federation of Malaya to the south and southwest. The area is 1,895 square miles. The population is predominantly Malay in culture and language and Islamic in religion.

The Pattani River, which rises in hills in the south that reach an elevation of 5,000 feet, flows through the center of the province. The provincial capital, the town of Yala, lies on the river and on the railroad line that runs from Songkhla to northeastern Malaya. A partly paved road runs north-south through the province to Malaya. The principal export products are tin, tungsten, and rubber. Chinese capital and labor are dominant in the mining and rubber industries.

Yala was one of seven small vassal states created when the Malay sultanate of Pattani, a vassal state of Thailand, was split up by the Thai after a rebellion broke out there in 1790. It was incorporated into the kingdom proper as a province after the reorganization of the Thai provincial government in the 1890's. Pop. (1980) 265,276.

WALTER F. VELLA.

**YALE**, yál, Elihu, English philanthropist: b. Boston, Mass., April 5, 1649; d. London, England, July 8, 1721. His father, David Yale, was an early settler in New Haven, Conn., but soon moved to Boston and then returned to England, where Elihu was educated. Entering the employ of the East India Company, Elihu went to Madras in 1672 and became governor of the company's fort there in 1687. In the meantime he had married a widow of means and, through lucrative investments and independent trading, amassed a considerable fortune. He was removed from office in 1692 and returned to England in 1699. He became famous as a collector of paintings and art objects and as a public benefactor. In 1717 he was elected a fellow of the Royal Society.

Yale never revisited New England, but he was persuaded to contribute substantial support to the new Collegiate School which had been founded at Branford, Conn., and then moved to New Haven. His gifts of salable materials, books, and other items were estimated at some £1,162. In his will he also left a legacy to the college, but it was held invalid in a series of court actions. The largest gift, in 1718, followed a suggestion from Cotton Mather that "if what is forming at New Haven might wear the name of Yale College, it would be better than a name of sons and daughters." After receiving this gift the trustees of the college wrote Yale of having "done our School the Honour of naming it with your Illustrious Name & have called it Yale-Coolledge." This was done at the school's first commencement (1718) in the building financed by Yale. After his death his body was returned for burial in the parish churchyard at Wrexham, Denbighshire, in north Wales, near the family country estate where he had spent most of his time during his years of retirement.

CLAUDE A. EGGERTSEN

*Professor of Education, University of Michigan.*

**YALE**, Linus, American locksmith and manufacturer: b. Salisbury, N.Y., April 4, 1821; d. New

York, Dec. 25, 1868. The son of a distinguished inventor and locksmith also named Linus Yale, he began work on bank locks about 1851. In a field marked by sharp competition, Yale produced three types of bank locks operated by keys designed to prevent picking and to allow changes in the combination. About 1862 he brought out the Yale Monitor bank lock, which marks the transition to the dial-operated combination lock.

Beginning about 1860, Yale gave much attention to smaller locks for general use. In 1861 and 1865 he took out patents for a cylinder lock with pin tumblers. The pin lock had first appeared in ancient Egypt, and much interest was taken in this principle in both England and the United States after 1790. Yale's lock excelled because it combined simplicity of construction with great variation in the possible combinations. It was also well adapted to quantity production. Because his factory at Shelburne Falls, Mass., was fully occupied with work on bank locks, he planned to build a new works, and in 1868 the Yale Lock Manufacturing Company at Stamford, Conn., was formed to produce the cylinder locks. After Yale's death that year, a partner, Henry Robinson Towne, carried on the business.

ABBOTT PAYSON USHER

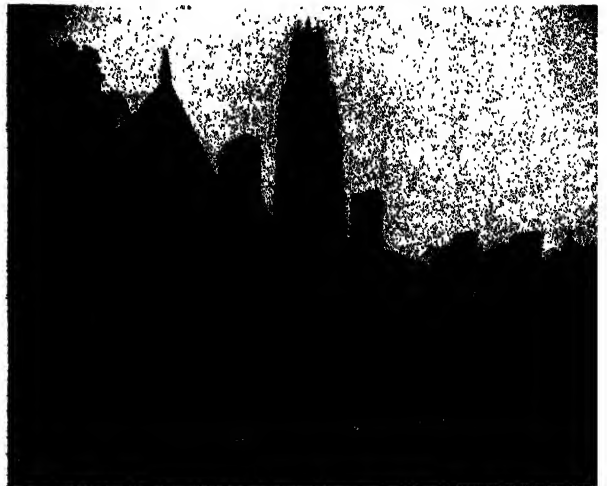
*Author of "A History of Mechanical Inventions"*

**YALE UNIVERSITY**, the third-oldest institution of higher learning in the United States, located in New Haven, Conn. It was founded in 1701 in Branford, Conn., as the Collegiate School. Classes were held initially in nearby Killingworth, Milford, and Saybrook before the institution moved in 1716 to New Haven and was renamed Yale College in recognition of the gifts of its first benefactor, Elihu Yale (q.v.). The first New Haven building, Yale College, was built in 1717; Connecticut Hall, constructed in 1750-1752, still stands. In addition to the college, the university has a graduate school and professional schools of art and architecture, divinity, drama, forestry, law, management, medicine, music, and nursing.

The Yale student body comes from every state

Harkness Memorial Tower stands out over the rooftops of the Jonathan Edwards College yard at Yale.

Philip D. Gendreau





P. Guerrero

The David S. Ingalls Rink, designed by a distinguished Yale alumnus, Eero Saarinen, was opened in 1958. It is used for team games and recreational skating.

of the United States and more than 75 other countries. Average enrollment is approximately 8,000, almost equally divided between graduate and undergraduate students. Over 30 different kinds of degrees are awarded annually. Women were first admitted for undergraduate study in 1969.

**Growth and Facilities.**—Although the Connecticut General Assembly did not authorize the name Yale University until 1887, President Ezra Stiles' "Plan of the University," which foreshadowed the organization of universities throughout the United States, was inaugurated as early as 1810, when the Medical Institution of Yale College was chartered. The Divinity School was begun with the creation of a separate department of theology in 1822, and the Law School affiliated in 1824. The art gallery, erected in 1832, was the first connected with a college to be built in the United States. It was followed by what is now known as the School of Art and Architecture, founded in 1865, and by the Peabody Museum of Natural History in the same year.

Meanwhile, an important step was taken in 1847 with the establishment of courses in graduate instruction through the Department of Philosophy and Arts. The gifts of Joseph E. Sheffield in 1861 consolidated this work into the Sheffield Scientific School, which became the leading scientific and engineering institution in the United States; its work is now carried on through Yale College and the Graduate School.

In 1861 the degree of doctor of philosophy was

awarded for the first time in the United States by Yale. The Graduate School was organized under its own dean in 1892, and women were admitted to it for the first time during the same year. The School of Music was established in 1894, the Forestry School in 1900, and the School of Nursing in 1923. The School of Engineering, which had formerly been a part of the Sheffield Scientific School, was established separately in 1932; and the Department of Drama, originally set up in 1924, became the School of Drama in 1955. Yale's new Art Gallery was completed in 1953. It was designed by Louis Kahn, who also designed the Yale Center for British Art, donated by Paul Mellon and inaugurated in 1977. The School of Organization and Management was established in 1974 and opened in 1975.

The Institute of Far Eastern Languages and the Bureau of Highway Traffic are also organized within the university. Summer work in Norfolk, Conn., is provided by the School of Art and Architecture and the School of Music. A summer language institute and other special programs are conducted by the Office of Teacher Training in the Graduate School.

After freshman year (during which housing is provided in the dormitories on the Old Campus), the students in Yale College live in 12 residential units known as colleges: Berkeley, Branford, Calhoun, Davenport, Timothy Dwight, Jonathan Edwards, Morse, Pierson, Saybrook, Siliman, Ezra Stiles, and Trumbull. Each has its own library, dining hall, kitchen, common rooms, squash courts, and accommodations for about 250 students. A master and his family live in each college, and students can associate with 20 or more members of the faculty who are appointed as fellows. The plan was initially made possible by gifts from Edward S. Harkness (B.A., 1897) and later supported by Paul Mellon (B.A., 1929).

Among the important benefactions of John W. Sterling (B.A., 1864) is the Sterling Memorial Library. Within it and the 42 subsidiary departments of the University Library are housed 4.5 million volumes, one of the largest collections in the world. It began with 40 books given by the founding fathers and had expanded to nearly 2,000 by 1718. Undergraduate literary and debating societies added volumes, a tradition perpetuated by friends and graduates.

The Church of Christ in Yale University, founded in 1757, is interdenominational, although Congregational in origin. The Chapel of St. Thomas More was constructed in 1938 for Roman Catholic students, and the Hillel Foundation was organized in 1942 to conduct Jewish services. There are also Episcopalian, Presbyterian, Methodist, Congregational, and Lutheran chaplains on the campus. Dwight Hall, the Young Men's Christian Association center at Yale, provides leadership and facilities for religious and social service programs.

A mile and a half west of the campus are 720 acres devoted to athletics and a golf course. The Yale Bowl, constructed in 1914, has a seating capacity of 70,900. Adjacent to the campus is Payne Whitney Gymnasium, a gift from Whitney's wife and his children, Mrs. Charles Shipman Payson and John Hay Whitney (B.A., 1926). The David S. Ingalls Rink, designed by Eero Saarinen (B.F.A., 1934), is used by the university hockey teams and for recreational skating.

**Administration.**—The final authority of the university is the Corporation, a body of 18 trustees

onsisting of the president of the university, the governor and lieutenant governor of Connecticut x officials, 10 fellows ("successors of the original trustees") serving until the traditional faculty retirement age of 68, and 6 alumni fellows elected every year by the graduates to serve for 6 years. The alumni trustees were substituted in 1872 for inactive senior state senators who had been placed in the Corporation in return for financial assistance from the state in the late 18th century.

Yale presidents (rectors until 1745) have been: Abraham Pierson (1701-1707), Samuel Andrew (1707-1719), Timothy Cutler (1719-1722), Elisha Williams (1725-1739), Thomas Clap (1740-1766), Naphtali Daggett (1766-1777), Ezra Stiles (1778-1795), Timothy Dwight (1795-1817), Jeremiah Day (1817-1846), Theodore Dwight Woolsey (1846-1871), Noah Porter (1871-1886), Timothy Dwight (1886-1899), Arthur Twining Hadley (1899-1921), James Rowland Angell (1921-1937), Charles Seymour (1937-1950), Alfred Whitney Griswold (1950-1963), Kingman Brewster, Jr. (1963-1977), A. Bartlett Giamatti (1978-1986), and Benno C. Schmidt, Jr. (1986-).

**Curriculum and Student Activities.**—Yale has adhered to the classical tradition of liberal arts education since its beginning. In the mid-19th century it introduced some of the new sciences and social studies; at the turn of the century it adopted the elective system and in due course the principle of "distribution and concentration." Since World War II a series of honors programs, the Scholars of the House Program for exceptionally able students, and the Directed Studies Program for qualified underclassmen (followed by the standard or interdepartmental major) have attracted special attention to a curriculum which is designed for either the generalist or the specialist, while maintaining the integrity of the basic liberal disciplines.

Student extracurricular activities are an important part of university life. The *Yale Literary Magazine* (established 1836) is believed to be the oldest college monthly, and the *Yale Daily News* (founded 1878) claims to be the oldest college daily. Among the many other activities are the Yale Glee Club, the Yale Band, the student radio station WYBC, the Political Union, and the Debating Association. Yale has seven junior fraternities and seven senior societies.

The university's alma mater song is *Bright College Years*, and several of its popular football songs were composed by Cole Porter (B.A., 1913). The mascot is a bulldog; the college color is blue. Students are known as Elis (after Elihu Yale).

**Alumni.**—Graduates of Yale have long taken an active interest in the affairs of the university. In 1890 they formed the first alumni fund in the United States and in 1906 organized the Alumni Board to keep graduates informed of Yale activities. The University Council, established in 1948, initiated a system of visiting committees that advise and assist in academic matters.

Yale's original charter called for the training of youth "for Public employment, both in Church and Civil State." In U.S. presidential cabinets since 1789, 8-12% of the members have been drawn from Yale. The college has produced several justices of the Supreme Court, and many of its graduates have become presidents or founders of other colleges and universities.

REUBEN A. HOLDEN,  
Secretary, Yale University.

**Further Reading:** Canby, Henry S., *Alma Mater: The Gothic Age of the American College* (1936; reprint, Ayer 1973); Deming, Clarence, *Yale Yesterdays* (1915; reprint, R. West 1984); Kelley, Brooks M., *Yale: A History* (Yale Univ. Press 1974).

**YALTA**, yál'tá, city, USSR, on the southeast coast of the Crimean Peninsula, in the Crimean Oblast of the Ukrainian SSR. The city lies in a natural amphitheater between the Crimean Mountains and the Black Sea. It has a subtropical climate and, with its many sanatoriums and rest homes, is the largest summer and winter resort in the Crimea. Many of the sanatoriums are former czarist villas. Local industries are small and consist mainly of food processing.

Yalta was the site of ancient settlements as long ago as the 1st century A.D. During the 14th and 15th centuries it was a colony of Genoa and then of Turkey from 1475 to 1783, when it was annexed by Russia. During the second half of the 19th century, Yalta grew from a village of 1,000 inhabitants to a large resort, where the czar himself had palaces. In 1945 the Yalta Conference of Joseph Stalin, Winston Churchill, and Franklin D. Roosevelt was held in a suburb. Population: (1979 census) 80,000.

ELLSWORTH RAYMOND,  
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**YALU RIVER**, yá'lōō' (Korean AMNOK-KANG), river, Asia, forming the border between Korea and China along its entire course of 500 miles. Its drainage area is over 24,250 square miles (about 12,300 square miles of it on the Chinese side). The Yalu originates in the Changpai Mountains and flows swiftly into Korea Bay. It is navigable for larger vessels for about 15 miles in the lower reaches, but only for small craft in the other sections. The river borders the Manchurian provinces of Kirin and Liaoning on the Chinese side, and North Pyongan, Chagang, and Yanggang in North Korea. Important cities at its mouth are Antung (Chinese) and Sinuiju (Korean); both of these have sawmills and other wood-processing industries to utilize the timber that is floated downstream.

The Yalu River has a hydroelectric power potential estimated at 1.5 million kilowatts, comparable to that of the Sungari River in Manchuria. A considerable portion of the billion rubles of Soviet aid to North Korea in 1954-1956 was expended for the restoration of the Supung hydroelectric power plant on the Yalu, after its near-destruction by United Nations planes in June 1952. Modernization in 1958 reportedly brought the installed capacity up to 700,000 kilowatts. North Korean surveys indicate that there are five locations on the Yalu that could sustain power plants as large as the Supung station.

The crucial importance of hydroelectric power provided to Manchurian industry by the Yalu may have been one of the reasons why the Chinese Communists entered the Korean War when United Nations troops reached the river. However, construction of electric power facilities in Manchuria since 1953 may have lessened the importance of the Supung installations to China.

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**YALUNG RIVER**, yá'lōōng', river, China, in western Szechwan. A canyon stream about 800 miles long, it rises in the Bayan Kara Mountains in southeastern Tsinghai (Chinghai) Province and

empties into the Yangtze River on the border of Yunnan, west of Hweli.

**YAM**, yām, the common name for plants of the genus *Dioscorea* of the family Dioscoreaceae (called the yam family), or for their tubers. In the United States certain varieties of sweet potato are incorrectly called yams. True yams, of which about 600 species are known, are found throughout tropical and warm temperate regions. Four species are native to the United States.

Yams are herbaceous vines whose stems twine consistently to the right or left, depending on the species. They have usually heart-shaped, prominently veined leaves; clustered small green, white, or yellow flowers; and three-angled capsules containing winged flat seeds. Yams are among the most important tropical root crops, some kinds being baked, boiled, or fried, some used for soup, and some dried and ground into meal.

The most commonly cultivated species, *D. alata*, is native to Southeast Asia but is grown in all warm countries. Its many varieties differ greatly in shape, color, and size of tubers. The skin is brown or black; the flesh, white to purple or red. The tubers may grow 8 feet long and weigh 130 pounds. Certain varieties of *D. bulbifera*, the air potato, are grown for their subterranean tubers; other varieties, for the aerial tubers borne at the base of the leaf stalks. Some poisonous or ill-flavored yams may be eaten after treatment to make them palatable. One of the most poisonous, *D. hispida*, is a chief famine food in Southeast Asia. Tubers of some species of yams contain compounds (botogenin, diosgenin) convertible into cortisone (q.v.). The cinnamon vine, *D. batatas*, so called from the odor of its flowers, is also cultivated as a garden ornamental.

See also SWEET POTATO.

JOHN W. THIERET.

**YAMA**, yām'a, in the Vedas or ancient sacred literature of the Hindus, the god of the dead, over whom he presides with the help of a twin sister, Yamī. They are looked upon as having been the first human pair, and one of the Vedic hymns tells how Yamī lured Yama to cohabit for the purpose of founding the human race. At a later period, the epics show Yama not only as presiding over departed spirits, but as judging them and assigning them to heaven, hell, or additional reincarnations. Still later, the Purāṇas (scriptures dealing with legend and history) picture him dwelling in an underworld city called Yamapura, where in the presence of many wives he sits on a throne of judgment while his messengers, called Yamadūtas, bring in the souls of the dead and carry them off to their assigned punishment or reward.

In literature and art Yama is usually represented as green in complexion, clothed in red, riding a black buffalo, armed with a mace and noose, and accompanied by fierce, four-eyed dogs. In shape he resembles a plump yaksha or tree spirit, and sometimes leaves rise over his head and shoulders. His dark green color, his big belly, his buffalo, his dogs, his association with trees, and above all his incestuous marriage indicate that he is either a pre-Aryan deity or an Aryan one who quickly adopted the ways and looks of the conquered people's gods. His transformation from an Aryan Adam to the judge of the dead in Dravidian form shows, perhaps, an Aryan fear that the conquered would revenge themselves

in the next life, if not in this one.

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**YAMAGATA**, yā-mā-gā-tā, PRINCE Arimoto, Japanese army commander and statesman: b. Hagi, Japan, April 22, 1838; d. Odawara, Feb. 1, 1922. He was the person chiefly responsible for reorganizing the Japanese Army on European models and for making the military class the most powerful faction in the government. Born into a lower order of the Choshu warrior clan, Yamagata was educated under the nationalist Shoin Yoshida and was prominent in the overthrow of the shogunate in 1867. The new imperial government sent him to Europe to study the military systems of France and Germany, and as minister of war in 1873 he built a new conscript army which defeated the Satsuma rebels four years later. In 1878 he became chief of the newly created general staff and in 1884 was made a count.

While minister of home affairs in control of the police, Yamagata supported the constitution of 1889, which kept power in the hands of the ruling oligarchy. Chiefly in order to prevent civilian interference in military affairs, he continued to take a leading part in politics for the next decade, serving as premier (1889-1891 and 1898-1900) and minister of justice (1892-1895). He originated the practice of having only active officers appointed as war and navy ministers, whose resignation could topple any cabinet that opposed them. As spokesman for the military faction in the government, he was the principal and finally victorious opponent of Prince Hirobumi Ito (q.v.) from 1890 to 1901. He proved a skillful strategist during the Sino-Japanese War (1894-1895), after which he became a marquis, and during the war with Russia he was again chief of the general staff (1904). After 1901 he retired from active politics, although he continued to exert some control over the political scene, becoming president of the privy council in 1905 and remaining Japan's most influential elder statesman until his death. He was created prince in 1907.

**YAMAGATA**, prefecture, Japan, in the northern part of Honshu Island. Its area is 3,601 square miles. It was created from the former Province of Uzen and a district of Ugo Province. The city of Yamagata (q.v.) is the capital.

The greater part of the prefecture is mountainous. The basic economic activity is agriculture, based on the cultivation of rice, of which Yamagata is a surplus producer. The center of rice production is the Shonai coastal plain facing the Sea of Japan. Sericulture and fruit growing are also important, and Yamagata is the cherry-producing center of Japan. Some petroleum, lignite, and natural gas deposits are exploited, and there are small fishing and forestry industries.

Near the city of Yamagata is the Mount Zao resort area, one of Japan's most popular skiing grounds. There are also many hot spring spas in the same area and in the city of Kaminoyama and its vicinity. Pop. (1983 est.) 1,256,000.

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**YAMAGATA**, city, Japan, capital of Yamagata Prefecture, in northern Honshu, on the Mogami



River, 39 miles by rail west of Sendai and 180 miles north-northeast of Tokyo. Formerly called Mogami, it was an important castle town from 1356 and served as the residence of various daimyo during the Tokugawa period (1603-1867). It became a city in 1881. The inner town still reflects the influences of the feudal period in its place names and street patterns.

Yamagata's economic activity centers about agriculture and manufacturing. Traditional household industries produce such items as iron kettles, Japanese umbrellas, Buddhist altars, and Paulownia papers. Modern industry, which developed after World War II, includes the manufacture of sewing machines and electrometallurgical products, the latter oriented toward the export market. The city is also the hub of commerce and transportation for the adjacent agricultural area, and a resort and sporting center (see YAMAGATA, prefecture). Yamagata University is situated here, and among the city's notable buildings are an ancient Shinto shrine, Hachiman, and a castle last occupied by the Mizuno family (1845 to 1868). Pop. (1960) 188,597.

GEORGE H. KAKIUCHI.

**YAMAGUCHI**, yä-mä-gōō-chē, prefecture, Japan, at the southwestern end of Honshu, the main island of Japan. The area is 2,348 square miles. The capital is the city of Yamaguchi (q.v.). The prefecture was created from the former provinces of Suwo and Nagato. In early Japanese history, this area functioned as a corridor of trade and communication between Korea and China and the main area of Japan. Yamaguchi produced many able statesmen and military leaders who were active in the struggles of the Meiji Restoration (1868) and during the Meiji period that followed. A few of these notable personalities were Hirobumi Ito, Aritomo Yamagata, Takayoshi Kido, and Taro Katsura (qq.v.), and Masujiro Omura.

Although manufacturing and mining are important in the prefecture, they are of recent origin; the traditional agriculture and fisheries were more important until the first quarter of the 20th century. Most of the level land is found on the narrow coastal plains, and rice is the main crop. Fishing is still one of the main industries, and Yamaguchi Prefecture ranks fifth in Japan in this respect, the port city of Shimonoseki (q.v.) being the center of the industry. Bofu (Hofu) and its coastal vicinity are known for salt production by evaporation, and the prefecture accounts for about 10 percent of Japan's production. Mining of coal, manganese, copper, and limestone is important, principally coal, the main fields being located near Ube (q.v.).

The manufacturing zone of Yamaguchi should be considered as an extension of the North Kyushu (Kita-Kyushu) industrial region. Shimonoseki and its vicinity have shipbuilding, metal, and chemical industries, and process fishery products; the Ube-Onoda district has chemical and ceramic factories; Bofu and its environs manufacture chemical fibers; the Tokuyama-Kudamatsu-Hikari district has primary metal, machinery, and chemical industries; and Iwakuni specializes in textiles. Pop. (1960) 1,602,207.

GEORGE H. KAKIUCHI.

**YAMAGUCHI**, city, Japan, capital of Yamaguchi Prefecture, in the extreme southwestern part of Honshu Island, on the Fushino River, 35 miles by

rail northeast of Shimonoseki. From the 14th century Yamaguchi was the seat of the Ouchi family, whose interest in foreign trade made the town one of the early centers of Western influence. A great number of scholars and court nobles who wanted to escape the disorders at Kyoto, then the imperial capital, sought the hospitality of the Ouchi and came to reside in Yamaguchi. Thus, by the 16th century, the town was a flourishing cultural center. In 1551 it was visited by St. Francis Xavier, the Jesuit missionary, who established a mission (destroyed in the 17th century) and made many converts. From about 1532 the power of the Ouchi family declined, and in 1557 it was dispossessed by the Mori family, which established its seat at Hagi, on the Sea of Japan. As a result, the prosperity and importance of Yamaguchi declined, but it rose to prominence once more when the Mori returned in 1863 and occupied the castle until the Meiji Restoration in 1868. During the struggles preceding the Restoration, Yamaguchi was a base of operations against the Tokugawa shogunate. It became a city in 1929.

Yamaguchi serves primarily as political, cultural, and educational center for the prefecture. Within the city are a monument to St. Francis Xavier and a well-known park, Kameyama, which is laid out on the site of the ancient villa of the Ouchi family. In the park are bronze statues of famous members of the Mori family who took part in the Restoration struggles. Yuda, in the southern part of the city, is a hot spring spa visited mainly by the local population. Pop. (1960) 87,695. See also YAMAGUCHI, prefecture.

GEORGE H. KAKIUCHI.

**YAMAL-NENETS NATIONAL OKRUG**, administrative division, USSR, located on the Arctic coast of Siberia just east of the Ural Mountains in the far north of Tyumen Oblast, Russian SFSR. The area of 258,800 square miles is a lowland with perpetually frozen soil, consisting of tundra and Arctic forest. The Ob River and its many tributaries are the chief means of transport. Unexploited deposits of iron, lignite, stone, and clay lie in the east Urals, and there are vast peat fields among the many northern lakes. Chief occupations are fishing, reindeer raising, and fur trapping, and the main industry is fish canning. Fish and furs are shipped to other parts of the USSR. The area was formed in 1930, and its capital is Salekhard. Russians and Nentsy (Mongols) predominate in the population. Pop. (1961) 64,000.

ELLSWORTH RAYMOND.

**YAMAMOTO**, yä-mä-mō-tō, Isoroku, Japanese naval officer: b. Nagaoka, Honshu, Japan, April 4, 1884; d. Solomon Islands, April 18, 1943. Of Samurai descent, he graduated from the Imperial Japanese Naval Academy in 1904 and served aboard the battleship *Nisshin*, at the Battle of Tsushima in 1905. After serving as assistant naval attaché in the United States (1919-1921), he became executive officer and instructor at the Kasumigaura Naval Air Station in 1924. From December 1925 to November 1927 he was naval attaché in the United States and in 1928-1929 commanded the aircraft carrier *Akagi*. He was then head of the Bureau of Naval Aviation of the Naval General Staff and in October 1933 became commander of Carrier Division One. During his various assignments on the Naval General Staff, he made tours of Europe and America to examine naval facilities.

ties. Appointed vice minister of the navy in December 1935 and commander in chief of the First Fleet in August 1938, he was commissioned admiral in November 1940 and was given command of the Combined Fleet in August 1941, a few months before Japan entered World War II.

The Japanese war plan in 1941 was first to seize the rich areas of Southeast Asia and then prepare to meet a United States movement from overseas. This strategy had been successful in the Russo-Japanese War, but Yamamoto claimed that the United States Fleet would have to be destroyed first, before that country's full potential could be brought against Japan. He forced his Pearl Harbor plan on the Naval General Staff, and it was a major success. His campaign against Midway six months later, however, took his country into divergent efforts, and defeat there enabled the United States to seize the initiative in the Solomons in August 1942. Near the end of the desperate struggle for these islands, Yamamoto was shot down in an air ambush over the Shortland Islands. He was granted the title of admiral of the fleet as of the day of his death. Yamamoto was a brilliant, devoted, confident man with a dynamic personality, but complete trust in his genius was one of the major causes of the Japanese defeat.

JOHN D. HAYES

*Rear Admiral, United States Navy (Retired)*

**YAMANASHI**, yä-mä-nä-shê, prefecture, Japan, situated inland on central Honshu island, west of Tokyo. The area is 1,724 square miles. It was formerly called Kai Province; its capital is the city of Kofu (q.v.) in the Kofu Basin. The prefecture is composed mostly of mountainous land; the only level areas are found in the Kofu Basin and in some of the small mountain valleys, so that agriculture is very limited. Mount Fuji (see FUJI) and the Akaishi mountain range form the boundary to the south and west, while the Kanto mountain range forms the boundary to the northeast and southeast. Along the northern foothills of Mount Fuji are the beautiful Five Lakes, a well-known recreation and resort area. Mount Fuji, the northern slopes of which lie in Yamanashi Prefecture, annually attracts perhaps 3 million visitors to the city of Fujiyoshida, mainly during July and August.

Among the special agricultural products of the prefecture are fruits (grapes, peaches, cherries, apples) and raw silk. The orchards and vineyards are concentrated on the alluvial fields along the foothills of the Kofu Basin. Sericulture is found mainly on the slopes of the northwestern and western mountains; the prefecture ranks third in Japan in the production of raw silk. Pop. (1983 est.) 816,000.

GEORGE H. KAKIUCHI

**YAMASAKI**, yä-mä-sä-kê, Minoru, American architect: b. Seattle, Wash., Dec. 1, 1912; d. Detroit, Mich., Feb. 6, 1986. He graduated in architecture from the University of Washington in 1934 and worked in New York City until 1945, when he moved to Detroit to become chief designer for Smith, Hinchman & Grylls. In 1951 the new firm of Leinweber, Yamasaki & Hellmuth (later Yamasaki, Leinweber & Associates; then Minoru Yamasaki & Associates) designed the Lambert Field-St. Louis Municipal Air Terminal, their first important building. The terminal, a spacious and impressive trio of reinforced concrete

groin vaults, won the First Honor Award of the American Institute of Architects (AIA) in 1956. In 1953 a trip around the world had exposed Yamasaki to a wide variety of architectural forms and ornament that had a decisive influence on his work. He concentrated his efforts on "sunlight and shadow, form, ornament, the element of surprise," which he felt were "little explored fields barely understood by today's architects." He asserted in addition: "I am for delight in architecture . . . a joyful quality . . . is essential in building a satisfying environment."

Among numerous other commissions were the U.S. Consulate General in Kobe, Japan (1957); the luxurious and elegant McGregor memorial Community Conference Center at Wayne State University (Detroit, 1958) and the Reynolds Metal Company Building (Southfield, Mich., 1959), both of which won AIA First Honor awards; the immensely popular United States Science Pavilion, a lacelike Gothic structure, at the 1962 Seattle World's Fair; the Civil Air Terminal in Dhahran, Saudi Arabia (1963), another AIA First Honor Award; and the twin towers of the World Trade Center (New York, 1974), in collaboration with Henry Roth & Sons. The twin towers of the World Trade Center in New York City, 110 stories high, are considered by some critics to be absurdly stylized.

HENRY A. MILLON<sup>2</sup>

*Professor of History of Architecture  
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**YAMASEE INDIANS**, yä'mo-sê, a North American Indian tribe of Muskogean stock, closely related to the Hitchiti and once inhabiting Georgia from the Ocmulgee River to the Savannah. The name is perhaps derived from Muskogean *yámase*, meaning "gentle."

Although first encountered by whites in 1521, the Yamasee remained relatively free from outside influence until the late 17th century, when they moved nearer St. Augustine, Fla., and thus were gradually involved in the English-Spanish rivalry for that region. In 1687 the tribe revolted against the Spaniards and were permitted to settle in the English colony of South Carolina. The resulting Yamasee War of 1715 against the English was an important turning point in relations between Indians and whites in the Southeast. Following their defeat by the English, the Yamasee returned to Florida and remained allies of the Spaniards, but their numbers slowly declined. From a population which, at its height, probably never exceeded 2,000, the tribe seems to have disappeared as an identifiable unit after the Seminole War (1835-1842), although the Oklawaha band of the Seminole Nation may represent its remnants.

A peculiar canoe stroke popular along the Southern coast was called the Yamasee stroke after its inventors.

FREDERICK J. DOCKSTADER

**YAMASHITA**, yä-mäsh-tä, Tomoyuki, Japanese general: b. Kochi Prefecture, Japan, Nov. 8, 1885; d. near Manila, the Philippines, Feb. 23, 1946. He graduated from the Army Academy in 1906 and rose to the rank of lieutenant general (1937) but held none of the key army posts before World War II. From December 1941 to February 1942 he commanded the Twenty-fifth Army in the swift conquest of Malaya and Singapore, which the British had thought impregnable. Though an able

commander, his success in Malaya owed much to careful planning, in which he had no part, and to mediocre leadership of the numerically superior opposing forces. He was promoted to general (February 1943) but transferred to a remote Manchurian command, reportedly because Prime Minister Tojo Hideki feared his popularity. On Oct. 9, 1944, soon after Tojo's downfall, Yamashita was sent to command the Fourteenth Area Army in the Philippines but was unable to block the American reconquest of the islands. In the first major war crimes trial after World War II, he was charged with command responsibility for permitting his troops to commit wholesale atrocities on Filipino and American civilians and prisoners of war. Though it was only inferentially shown that he knew of the atrocities, an American military commission convicted him of violation of the laws of war, and after unsuccessful appeals to the Philippine and the United States Supreme Court, he was hanged.

ROBERT M. SPAULDING  
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**YAMOUSSOUKRO**, yá-mōō-sōō-krō', a city in the Ivory Coast, 160 miles (250 km) northwest of Abidjan. A village when President Félix Houphouët-Boigny was born there in 1905, it became the national capital in 1983, but most government business continued to be conducted in Abidjan.

Yamoussoukro's redevelopment began in the mid-1970's. A six-lane highway was constructed from Abidjan, and the town acquired wide boulevards, a presidential palace, a large hotel, and technical colleges. The Roman Catholic Basilica of Our Lady of Peace, built by the president, is larger than St. Peter's in Rome. Population: (1990) about 100,000.

**YAMUNA RIVER**, yu'mōō-nā, in India, the major right-bank tributary of the Ganges. It rises in the high Himalaya and flows through the Siwalik Hills onto the North Indian Plain, describing a broad arc convex to the southwest along its course of 860 miles (1,375 km). The Yamuna (Jumna), which is nonnavigable, flows past Delhi, Mathura, and Agra before entering the sacred Ganges at the pilgrimage city of Allahabad. Its chief tributary is the Chambal on its right bank. Several important canals flow from headworks on the Yamuna to irrigate extensive tracts on either bank. The long, narrow, fertile region between the Yamuna and the Ganges—called the Doab—is almost entirely irrigated.

JOSEPH E. SCHWARTZBERG, *Editor of*  
"A Historical Atlas of South Asia"

**YAN FU**, yen fōō (1854–1921), Chinese naval officer and scholar. He was born on Jan. 8, 1854, in Fujian (Fukien) province. When his father's death interrupted his classical Chinese education he entered the naval academy in Fuzhou, where he learned English and Western sciences before graduating in 1871. After further study at the Greenwich Naval Academy in England, he was dean and later chancellor of the naval academy in Tianjin from 1881 to 1900.

Yan Fu (Yen Fu) sought to apply his newly gained knowledge of the British political system and European liberal thought to the problem of China's weaknesses and subservience to the West under the late Qing (Ch'ing) dynasty. Rejecting the prevalent notion that Western means

(technology) could be made to serve Chinese ends (values), he advocated the adoption of liberal Western principles—but in the interest of enhancing the wealth and power of the state rather than the freedom of the individual; he regarded the Chinese as unready for democratic self-government. He became enormously influential by promoting his ideas through translations of and commentaries on works by T. H. Huxley, J. S. Mill, Adam Smith, Montesquieu, and especially Herbert Spencer.

As a conservative Westernizer, Yan Fu disapproved of the republican revolution of 1911 and gave reluctant support to the reactionary regime of Yuan Shikai (Yüan Shih-k'ai). The carnage of World War I disillusioned him with the West, and he came to believe that the ideas of Confucius and Mencius would best serve the world. Yan Fu died in Fuzhou on Oct. 27, 1921.

**YAN Liben**, yen lê-bun (died 673), Chinese painter of the early Tang (T'ang) period. The son of a prominent painter and court official, and the brother of another, Yan Liben (Yen Li-pen) was born about 600. He was commissioned by the second Tang emperor, Tai Zong (T'ai Tsung), to paint portraits of officials and scholars, and he became a minister of state himself. His work is best known from the *Scroll of the Emperors* (Museum of Fine Arts, Boston), depicting 13 pre-Tang rulers and their attendants. The first six groups are copies; the last seven, perhaps not. The weight and volume of the figures and the design and interrelationship of the groups are especially noteworthy. The painting's sculptural quality suggests the *Six Horses* (two in the University Museum, Philadelphia), carved in relief on a stone tablet for the emperor's tomb from Yan's designs. Yan was also noted for his interpretations of religious themes and for paintings that showed foreigners.

**YANA INDIANS**, yā'nā, a tribe of North American Indians belonging to the Hokan linguistic family and at one time inhabiting the upper Sacramento Valley of California from the Pit River to Rock Creek. Yana means "person." The name Nôsi, or Nôzi, formerly applied to this tribe, is obsolete.

The Yana and their kinsmen the Yahi never had a reservation area, but they played a role in California history quite disproportionate to their small population. The California-Oregon trail traversed Yana territory.

Long considered an anthropological mystery, the Yana have become better known, and the belief that they had an Eastern origin has been discarded. One peculiarity of their language is the existence of two forms of speech, one for the men and the other for the women.

The Yana and Yahi population never exceeded 1,500, and they suffered greatly at the hands of the white settlers. In a single night attack, a group of miners surrounded the main Yana village in 1864, massacring all but about 50 individuals. Today few if any Yana survive.

The discovery in 1911 of Ishi, the last surviving Yahi, who lived thereafter at the University of California Museum of Anthropology until he died in 1916, sparked interest in Yahi culture. Famed as the "last Stone Age man," he still knew how to make stone arrowheads and retained many primitive customs.

FREDERICK J. DOCKSTADER\*  
Author of "Great North American Indians"

**YAN'AN**, yen'an', a historic town in northern China, in Shaanxi (Shensi) province, 170 miles (270 km) north of the provincial capital, Xi'an (Hsian, Sian). It is situated on the Yan River, surrounded by hills that are honeycombed with caves and terraced for farming. The area is part of a rugged plateau covered with dry, porous, wind-deposit soil known as loess. Yan'an (Yen-an) is a regionally important economic and cultural center, with wool-weaving industries and a university. It is best known, however, as the headquarters of the Chinese Communist Party from 1937 to 1947 during its struggle with both the Japanese and the Nationalist (Kuomintang) Chinese for control of China. Points of interest are the Museum of the Revolution, the caves where Mao Zedong (Mao Tse-tung) and other revolutionary leaders lived during the "Yan'an Period," a pagoda built during the Song (Sung) dynasty (960-1279), caves with Buddhist statues, and a Daoist (Taoist) hermitage.

As early as the 1st century A.D., Yan'an was a frontier military post, and in the 6th century it became a local administrative center. It retained its military defense significance until China's northern frontier was pacified in the late 17th century. The town again rose to prominence with the arrival in 1937 of the Red Eighth Route Army, which had completed its "Long March" from former bases south of the Yangtze River. Until 1947, Yan'an was the headquarters of the Central Committee of the Chinese Communist Party and the focal point of the party's revolutionary activity. It also served as the administrative center of a Communist-controlled region with 1.5 million people. During the Sino-Japanese War (1937-1945) the town was bombed by the Japanese and destroyed; but the Communist leadership stayed on, taking up residence in nearby caves. In the Chinese civil war that followed Japan's defeat, Yan'an was held by Kuomintang forces in 1947-1948. Rebuilt after the establishment of the People's Republic of China in 1949, Yan'an came to be regarded as a national shrine. Population: (1982 census) of the municipality, 250,847.

**YANBU**, yan'boō, a city on the Red Sea coast of Saudi Arabia, 100 miles (160 km) west of Medina. For centuries it was a way stop for pilgrims visiting the holy cities of Medina and Mecca and was renowned as a center of date production and export. By the 1970's it had a permanent population of about 10,000.

Because of congestion at the major port of Jidda, 200 miles (320 km) to the south, the harbor facilities at Yanbu (Yenbo) were expanded and improved after 1970. At the same time the Saudi government resolved to invest its vast petroleum revenues in projects that would make the country an industrial power. Subsequently a desert tract 5 miles (8 km) south of Yanbu became the site of a huge complex for oil refining, natural-gas processing, petrochemicals manufacturing, and light industries, with pipeline service from the Persian Gulf oil zone, a new industrial port, and a modern urban area that initially accommodated 30,000 people.

**YANCEY**, yan'sē, William Lowndes (1814-1863), American political leader, who led Alabama into secession. He was born in Ogeechee Falls, Ga., on Aug. 10, 1814. He attended Williams College in Massachusetts and studied law privately in

Greenville, S.C. Initially opposed to nullification (see NULLIFICATION), he became an advocate for states' rights and strict construction of the Constitution after moving to Alabama in 1837. He defended his views as editor of the *Cahawba Southern Democrat* and the *Wetumpka Argus*.

Yancey was elected to the lower house of the Alabama legislature in 1841 and to the state senate in 1843. He resigned in 1846 to practice law but soon was drawn back into politics, opposing the Wilmot Proviso and the Compromise of 1850. After Abraham Lincoln's election in 1860 had prompted secession, Yancey tried and failed to gain European recognition for the Confederacy. He then served in the Confederate Senate. He died in Montgomery, Ala., on July 27, 1863.

**YANG**, yāng, Chen Ning, Chinese-American physicist; b. Hefei, Anhui province, China, Sept. 22, 1922. He was encouraged to study mathematics and the physical sciences by his father, a prominent teacher of mathematics. After graduate work in China, he was awarded a scholarship for study abroad and in 1945 entered the University of Chicago, where he received his doctorate in physics in 1948. The following year he was named a member of the Institute for Advanced Study at Princeton, N.J., and became a full professor there in 1955. In 1957, Yang shared the Nobel Prize in physics with his friend and colleague Tsung Dao Lee for their joint work in upsetting the principle of conservation of parity as a fundamental law of nuclear physics. They proved theoretically that parity, or "mirror symmetry," might not hold true for certain types of subatomic particles. Their hypothesis was later confirmed by experimental scientists at the National Bureau of Standards, Columbia University, and the University of Chicago. Yang's other contributions were chiefly in the fields of statistical mechanics and symmetry principles.

**YANG Zhu**, yāng (440-360 B.C.), Chinese philosopher. A representative of Daoism (Taoism), he became widely known mostly through scathing criticisms by Mencius, the Second Sage among the Chinese, who said of him that he "adopts the principle of 'each one for himself,' and would not sacrifice a single hair for the benefit of the whole world."

Very little is known about the life of Yang Zhu (Yang Chu), and except for chapter 7 in the Daoist book *Liezi* (*Lieh-tzu*), bearing the title "Yang Zhu," nothing is left of his teaching. In this brief chapter is set down clearly and candidly a view of life and value as refreshing as it is unorthodox. His critics have called him an egoist, hedonist, pessimist, and fatalist. Far from being a debauchee or a prophet of doom, Yang Zhu wanted to be true to nature and to conduct himself accordingly. For human life, self-preservation constitutes its beginning and happiness its end. To live pleasurably is to live naturally. Imposition of assistance upon others is as bad as infringement. With regard to benefiting the world by sacrificing a hair, Yang Zhu observed, "When nobody would sacrifice a hair, when nobody would try to benefit the world, the world would become orderly." Yang Zhu's philosophy is, in line with that of Daoism, one of letting things alone and "to live and let live."

Y. P. MEI, Author of  
"The Ethical and Political  
Philosophy of Motse"

**YANGCHOW** or **YANG-CHOU**, yǎng'jō', municipality, China, in west central Kiangsu Province, on the Grand Canal just north of the Yangtze River, 15 miles north of Chenkiang. It is one of three important urban market centers north of the Yangtze River, along with Nantung and Tai-chow. Yangchow serves as an agricultural market, dealing especially in rice, cotton, corn, wheat, beans, kaoliang (a grain sorghum), and salt. Its rice-trading activities are concentrated in the suburb of Chiangtu (formerly Siennümiao), just northeast of the city, and the salt trade takes place mainly in Shihherwei to the southwest. Yangchow is also a light-industrial center, with some machine shops. As a commercial and trading center, it flourished during the Sui and Tang dynasties (590-906 A.D.), when the Grand Canal was used extensively for inland water navigation. At that time, the city was the capital of the Yang Kingdom. Marco Polo, who was honorary governor of the city from 1282 to 1285 A.D., referred to it as Yangiu. It was called Chiangtu from 1912 to 1949, when it became a municipality and assumed its present name. Population: (1982 census) 304,959.

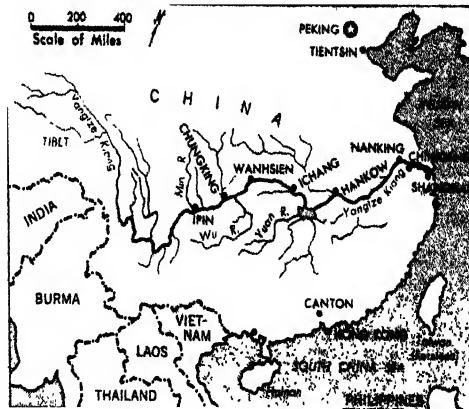
**YANGCHÜAN** or **YANG-CH'ÜAN**, yǎng'chü-än', municipality, China, in east central Shansi Province, about 55 miles east of Taiyuan, on the Peking Highway and the Taiyuan-Shihchiachuang Railway. It is an important railroad town, in the center of a coal- and iron-ore-mining area, and is closely associated with the 13th century iron-working town of Pingting, a few miles to the south, which it superseded after the construction of the Taiyuan-Shihchkiachwang Railway (completed in 1907). Yangchüan is the site of a small blast furnace (original designed capacity 20 tons daily), built by the Paochin Company prior to World War I, which supplies limited amounts of pig iron to the large steel mills in Taiyuan. The city is noted for its metal handicrafts, pottery, and gold and silver ware. A new electric power line was built in the early 1950's between Yangchüan and Taiyuan. Population: (1982 census) 466,563.

BARUCH BOXER

**YANGON.** See RANGOON

**YANGTZE KIANG**, yǎng'sē kē-äng' (Chin. CH'ANG KIANG or CH'ANG CHIANG), river, China, the longest and commercially most significant river in the country. It flows for 3,430 miles from the highland area in northeastern Tibet and southwestern Tsinghai Province through the Red Basin of Szechwan Province and across the provinces of Hupei, Hunan, Kiangsi, Anhwei, and Kiangsu, and finally empties into the East China Sea near Shanghai. From its point of origin, the Yangtze drops to 1,000 feet above sea level at Ipin, Szechwan, the head of navigation. This section is called the Kinsha (Chinsha) River. After passing through the Szechwan cities of Luchow, Chungking, and Wanh sien, the river traverses the famous Yangtze Gorges just before Ichang in Hupei (130 feet above sea level), after receiving the Wu River on the right. Ichang, the head of navigation for river vessels, is also the site of one of the projects suggested in the 1959 program for the development of the Yangtze River resources; a huge hydroelectric plant was scheduled for construction on the river at the gorges about 4 miles above Ichang. Another project proposed entails

the diversion of water from the upper portion of the Yangtze to the Yellow River in Tsinghai Province; this scheme, when completed, will provide irrigation water for the northwest and eventually for the Tsaidam and Tarim basins.



Map showing the course of the Yangtze Kiang.

From Ichang to the East China Sea there is an insignificant drop in the altitude of the Yangtze. For the first 800 miles from Ichang, the river drops about  $2\frac{1}{2}$  inches per mile. For the last 200 miles, the Yangtze flows virtually at sea level. It is estimated that the mean volume of water discharged at the mouth of the river is 770,000 cubic feet per second, while the sediment deposited at the mouth amounts to about 6,428 million cubic feet annually.

The Yangtze is the major east-west transportation artery for central China. It serves a wide hinterland throughout its basin and is navigable for river steamers of from 5,000 to 10,000 dead-weight-ton capacity as far inland as Hankow. To the east of Ichang it widens considerably, facilitating easy passage at least as far as Kiangling, where the entrance of tributaries quickens the current and often leads to a major flood problem. The Kiangling area is the site of a major flood-control project, which was completed in 1952.

The Yangtze was named for the ancient kingdom of Yang (c. 1000 B.C.), which was located along its present lower course. At one time the river entered the East China Sea at a point further south; this earlier course crossed Tai Lake and Hangchow Bay. Today the Yangtze's navigable portions traverse some of the major economic centers of China, and the region it serves is one of the world's most densely populated areas.

BARUCH BOXER  
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**YANKEE**, yǎng'kē, originally a nickname for New Englanders, a usage firmly established before the American Revolution. During the Civil War, Southerners applied the word, often in a derogatory sense, to any Northerner or member of the Federal armies. Since the Revolution the British have used the term for all Americans, a custom that became particularly widespread during both world wars when American soldiers, Southerners and Northerners alike, were referred to as Yanks or Yankees.

The etymology of the word is uncertain, but



*Yankee* is generally believed to be a back-formation of the Dutch *Jan Kees*, a variation of *Jan Kaas* (John Cheese), a long-standing nickname in Germany and Flanders for a Hollander. This appellation was also used by the English to designate a Dutch pirate and, in the colonies, as a term of contempt for all the Dutch. Why the term was transferred from the Dutch to colonists in general is not clear. It is certain, however, that Yanky or Yankey was common enough as a surname or nickname for individuals in British colonial areas during the 18th century.

Some theorists have sought the origin of *Yankee* among the American Indians. A Cherokee term for slave or coward, *eankke*, and an Indian mispronunciation of *English* or the French *Anglais* have been offered as sources. But linguists are skeptical about the existence of *eankke*, and the Indians, having their own names for whites, seldom, if ever, used the terms *English* or *Anglais*. However, *Yankee* may well be connected with a Scots dialect word *yankie*, meaning "sharp" or "clever," as in the phrase "a yankie, good horse." In 19th century America to *yankee* meant to cheat, and, as a noun, *Yankee* has become synonymous with thrift, business acumen, and craftiness.

Such associations stem from the subliterary and folk image of the Yankee storekeeper and peddler. Originally, the sharp Yankee was a comic rural figure, an American development of the Yorkshireman, who plays his tricks or bites in British song and story. His haunt was the country store and tavern where he told his jokes, swapped his goods, and hazed city fellows and slower-thinking townsmen. From this regional start, he became national in range as the frontier opened and he went west to try to sell the backwoodsman things they neither wanted nor needed. Typical of the motifs used in Yankee trickster tales are these two. A deacon checks to see whether his clerk has watered the rum, wetted the tobacco, floured the ginger, and put chicory in the coffee. He then says, "Good lad, now come to your prayers!" A trader sells a horse, saying it has two faults, one of which he will reveal before the deal is closed, one after. The first fault is that the horse is hard to catch; the second, that he is not worth anything once caught.

Sam Hyde, Indian half-breed from Dedham, Mass., is a true folk figure about whom Yankee tales once accumulated. More famous are two journalistic creations of the early 19th century: Sam Slick, the Yankee peddler created by Thomas Chandler Haliburton (1796-1865), and Jack Downing, the cracker-barrel philosopher and common-sense politician created by Seba Smith (1792-1868) and imitated by many others. To most people, however, Benjamin Franklin, who preached his gospel of industry and frugality and wangled his way to fame and fortune, is as Thomas Carlyle called him "the father of all the Yankees."

TRISTRAM P. COFFIN,  
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American Folklore Society.

**YANKEE DOODLE**, yāng'kē dōō'dəl, a popular song of the United States, which for more than two centuries has enjoyed the status of a national air. The origin of the song is uncertain, but most of the legends concerning it place its beginnings toward the middle of the 18th century, during the French-Indian wars. The most common legend concerns Dr. Richard Shuckburg, a physician at-

tached to the British Army at Albany, who composed the song to make fun of the provincial Yankee troops. There is little substantiation for this story, but research has established that the song and many of its verses were probably composed during the 1750's and that it was used in derision of the colonials by the British. From then it became very popular, and by 1767 many versions were current in the American colonies. The first known appearance of the song in print occurred in 1782, when it appeared in James Aird's *A Selection of Scotch, English, Irish, and Foreign Airs*, which was published in Glasgow. The fact that this collection contains several Virginia airs and a Negro jig lends weight to the belief that the tune of *Yankee Doodle* is actually of American origin. Its first known American printing was as part of Benjamin Carr's *Federal Overture*, composed in 1794 and published in Baltimore in 1795.

The use of *Yankee Doodle* as a song to poke fun at the Yankees continued to the early days of the Revolutionary War. It is said that when Col. Hugh Percy's troops marched out of Boston in April 1775, bound for Lexington and Concord, they kept step to the strains of *Yankee Doodle*. At Concord they were routed by the colonial troops, and as they beat a disordered retreat to Boston the Yankees followed them, themselves singing *Yankee Doodle*. From that time the song has been considered an American patriotic air.

JOHN TASKER HOWARD.

**YANKEE PENNAMITE WARS.** See PENNAMITE WARS.

**YANKTON**, yāng'k'tən, city, South Dakota, seat of Yankton County, 60 miles southwest of Sioux Falls, on the Missouri River. Set in a grain- and cattle-raising area, the city is a railroad and shipping center and has a municipal airport. Machine tools, crates, sheet-metal products, and electronic components are manufactured, and poultry and meat products are processed. Yankton is the site of Mount Marty College (Roman Catholic, women), Yankton College, and the state mental hospital. West of the city, on the Missouri River, is Gavins Point Dam. Lewis and Clark Lake, formed by the dam, is a popular recreation area, below the dam is one of the largest fish hatcheries in the United States. Settled in 1858 and platted in 1859, Yankton was named after the Yankton Indians, who lived in the area. The city was the capital of Dakota Territory from 1861 to 1883. It was incorporated as a town in 1862 and as a city in 1869. Government is by commission and manager. Population: 12,703.

EDA F. LIVINGSTON

**YANKTON INDIANS** (from Indian *thanke tonwan*, end village), one of the three major divisions of the great Dakota Indian family of North America. With the related Yanktonai Indians (q.v.), they constitute the Middle Dakota group, the other two being the Santee and the Teton. The homeland of the Yankton was apparently around Mille Lacs and Leech lakes in Minnesota, where the explorer Louis Hennepin located them in 1683. See also DAKOTA INDIANS.

FREDERICK J. DOCKSTADER

**YANKTONAI INDIANS**, yāngk-ta-nā' (f Indian *thanke tonwana*, little end village), the Yankton Indians (q.v.) one of the three major divisions of the Dakota Indian family of North

America. They are regarded as older than the Yankton, and it was from the Yanktonai that the Assiniboin split in ancient times to form a separate tribe. The ancient homeland of the Yanktonai was a large area north of Mille Lacs Lake, Minn.

See also DAKOTA INDIANS.

FREDERICK J. DOCKSTADER  
Author of "Great North American Indians"

**YANTAI**, yen'ti', a city in northern China, on the north coast of the Shandong (Shan-tung) Peninsula in Shandong province. It is situated on a spacious bay protected by a long promontory and islands. The port of Yantai (Yentai), on the south side of the bay, was built early in the 20th century to handle ocean shipping denied access to the northside port of Zhifu (Chih-fu, Chefoo), which had gradually silted. Zhifu, now a fishing center, lies within the extensive and partly rural Yantai municipality.

Yantai is the processing and distribution point for a major fishing operation and for a local agriculture that is noted for its apples and grapes. The chief manufacturing industry is food processing, which includes flour milling, wine making, brandy distilling, and the canning of fish, fruits, vegetables, and meat. Small-scale engineering produces steel and machinery for the area. Yantai is also a summer resort, with excellent beaches.

The ancient port of Zhifu was opened to foreign trade in 1863. The new port of Yantai that superseded it was itself eclipsed by Qingdao (Ch'ing-tao, Tsingtao), developed downcoast after 1898. Yantai became a municipality in 1933 and emerged as the major city on the north coast of the peninsula by being linked into the Qingdao-Jinan rail line in 1955. Under a plan approved in 1978, an economic and technological development zone was established in Yantai for foreign investors. Population: (1982 census) of the municipality, 384,336.

**YAO**, you, a Bantu-speaking people of Africa living primarily in southern Malawi and northwestern Mozambique, and to a lesser extent in southern Tanzania. The Yao homeland was in northeastern Mozambique, where they early came into contact with Arab traders from Kilwa, on the coast of Tanganyika (mainland Tanzania). By the 18th century they were active in ivory trade with the coast. Subsequently they spread into Malawi and Tanganyika as traders and slavers.

After their subjugation by the colonial powers in the 1890's and the end of the slave trade, the Yao lived by subsistence agriculture and migratory labor. They also maintained their warlike traditions by enlisting readily for military service. Politically, they have never been organized into a single unit. They live in small villages, some of which recognize a common chief who has ritual as well as political authority. Their system of descent and inheritance is matrilineal. Thus, on marriage a man moves to the village of his wife, where his rights are minimal.

Nominally Muslims, the Yao have vestiges of an ancestor cult, and belief in sorcery is strong. Important rituals include rain ceremonies, initiation ceremonies for boys and girls, and first pregnancy ceremonies for women.

ELIZABETH COLSON, Author of  
*"Tradition and Contract: The Problem of Order"*

**YAO**, yā-ō, a city in Japan, in Osaka prefecture, just east of Osaka. The main part of the city has two religious centers, established in the 15th and 17th centuries, and religious festivals are held annually.

Yao is part of the Osaka industrial area. Traditional industries are the manufacture of cotton textiles and items such as brush and thongs for wooden clogs (*geta*), produced in households or in small factories. Modern manufactures include machinery, chemicals, and metals. Yao also serves the surrounding area as a local market center and is a residential suburb of the nearby city of Osaka.

Yao became a city in 1948 through the consolidation of two towns and three villages. Population: (1985 census) 276,397.

GEORGE H. KAKIUCHI  
University of Washington

**YAOUNDE**, youn-dä', the capital of Cameroon. It is situated in a southern highland area 125 miles (200 km) east of the seaport of Douala. Although secondary to Douala in commercial importance, Yaoundé is a transportation hub and the distribution point for one of Cameroon's most productive agricultural regions. Local manufactures include foodstuffs, beverages, cigarettes, textiles, soap, building materials, and printed matter. Besides being the country's administrative center, Yaoundé is its chief center of learning. It contains the University of Yaoundé, the national library and archives, and numerous specialized schools and research institutes.

Yaoundé was founded by the Germans in 1888 as a base for expanding into the interior of their Kamerun protectorate. In 1922, when most of Kamerun passed to France under the name Cameroun, the French made the city the seat of their administration. Later they completed the rail line from Douala begun by the Germans. Except in 1940-1946, Yaoundé remained the capital during the years of French government and after the country became independent in 1960. Population: (1986) 654,000.

**YAP**, yap, a federated state of Micronesia in the tropical Caroline Islands of the northwestern Pacific Ocean. It consists of the four islands of the Yap group and numerous smaller ones, notably those of Ulithi and Woleai atolls. The state has a total land area of 46 square miles (119 sq km). The capital is Colonia, on Yap Island.

The Yap group is hilly, with fertile soils supporting a dense growth of palms, crotons, and bamboo as well as varied crops. Copra is the main export; tourism also contributes income. The Yapese are Micronesians who exhibit some Melanesian physical traits and speak Yapese, an Austronesian language. They are noted for their traditional stone money in the form of disks—some huge—with holes in the center. They transported the aragonite stone from Palau, 275 miles (440 km) distant, beginning before the 16th century.

Probably the first Westerner to sight Yap was a Portuguese sea captain in 1526. Afterward the group came successively under the jurisdiction of Spain (1686), Germany (1899), Japan (1920), and the United States (1947). From 1979, Yap was one of the Federated States of Micronesia, which gained sovereignty in free association with the United States in 1986. Population: (1980 census) 8,100.

**YAQUI INDIANS**, yā'kē, one of the two surviving tribes of the Cahita language family, living in southern Sonora, Mexico.

The name is Indian for "chief river"—that is, the Yaqui River, along which the tribe lives. The most warlike of the Cáhita people, they have stoutly resisted encroachment upon their territory and even today maintain a large degree of independence and isolation. In 1906–1907 the Mexican government tried to break this resistance by forcible deportation of large numbers to Yucatán and Tehuantepec; this action and the enrollment of the men into the army resulted in the widespread scattering of the Yaqui throughout Mexico. Two small enclaves also exist in southern Arizona.

Nominally Roman Catholic, the Yaqui combine aboriginal and European religious practices to an extreme degree; their elaborate ceremonial is climaxed during Easter week with the Pascua rites, which are familiar to many travelers in the Southwest. The Yaqui use a variety of masks, costumes, and musical instruments in their dances, which amply demonstrate their inventiveness and talent for music. They are most closely related to the Mayo Indians (q.v.). The exact Yaqui population is not known but was estimated in 1950 as between 15,000 and 20,000 and in 1980 at about 22,000.

FREDERICK J. DOCKSTADER.

**YAQUI RIVER**, river, Mexico, mainly in the State of Sonora but rising in Chihuahua, where its headstream is named the Papigochic, later the Aros. In Sonora, at the junction with the Bavispe flowing from the north, it becomes the Yaqui proper. Soon after it is met by the Moctezuma, another tributary from the north, and flows thence south-southwest for about 200 miles into the Gulf of California. The river is scarcely navigable because of the rugged mountain country and many canyons. Its basin, including tributaries, covers about 34,000 square miles, of which about 800 are in the United States where tributaries of the Bavispe originate. An official commission is developing the region with irrigation networks fed by three large reservoirs: the Guadalupe on the Papigochic near Ciudad Guerrero; the Angostura on the Bavispe; and the Alvaro Obregón just north of Ciudad Obregón.

I. NICHOLSON.

**YAQUINA RIVER**, yā-kwē'nā, river, Oregon, rising northwest of Corvallis, in Benton County. It flows 50 miles in a westerly direction past the city of Toledo and empties into Yaquina Bay at Newport.

**YAQUT**, yā-kōōt' (Ar. YAQŪT IBN-'ABDULLĀH AL-RŪMĪ), Arab geographer and lexicographer: b. in Byzantine territory, 1179; d. Aleppo, Syria, 1229. He was of Greek parentage, as his surname al-Rūmī indicates. Bought as a slave by a Syrian merchant from Hama, he served for many years as a traveling clerk before he was enfranchised. He then continued his travels as a copyist and seller of manuscripts in Syria, Egypt, Iraq, and Iran. From material that he collected firsthand and culled from books, he started compiling in Mosul, Iraq, around 1222, what turned out to be the most comprehensive geographical dictionary in Arabic, *Mu'jam al-Buldān* (modern ed. by Ferdinand Wüstenfeld, 6 vols., Leipzig 1866–73). In it the names of places are alphabetically ar-

ranged and correctly vocalized, and the geographical data are enriched by historical etymological and scientific material. In addition, Yaqut wrote a dictionary of geographic homonyms, *al-Mushtariq*, and another of learned men, *Mu'jam al-Udabā'* (modern ed. by David S. Margoliouth, 7 vols., Leiden 1907–27).

PHILIP K. HITT.

**YARACUAY**, yā-rā-kwē', state, Venezuela, in the northern part of the country, 2,740 square miles in area, between the Sierra de Aroa on the west and the end of the coastal range on the east. Between the mountains are broad valleys, of which those of the Yaracuy River, from which the state takes its name, and of the Aroa River are notable. Part of the Caribbean coastal plain, with rich vegetation, lies in the north. Except in the mountains, the climate is tropical, and heavy rain falls from June to December. Sugarcane, cacao, corn, rice, and coffee are grown. Mineral resources include copper, iron pyrite, lead, platinum, and coal. San Felipe is the capital. Pop. (1983) 304,963.

**YARACUY RIVER**, river, Venezuela, in Yaracuy State. Rising north of Urachiche, it flows northeast for about 75 miles to Triste Gulf in the Caribbean Sea, 18 miles west-northwest of Puerto Cabello. To the west is an offshoot of the Andes and to the east the Venezuelan coastal range. In its valley sugarcane, cacao, cotton, tobacco, corn, rice, and fruit are grown. Small craft may navigate the river.

**YARD**, yārd, a unit of length equal to 3 feet or 36 inches. A square yard contains 9 square feet, and a cubic yard 27 cubic feet. The yard as a unit of measure is derived from early English usage. See also MEASURES AND MEASURING SYSTEMS.

**YARMOUTH**, yār'māth, town, Massachusetts, in Barnstable County, stretching across the center of Cape Cod, between Barnstable and Dennis. It is a popular summer resort area. Cranberries and vegetables are raised for the market. Yarmouth was incorporated in 1639 and named for Great Yarmouth in England. In the earlier 19th century it was a noted fishing center. Points of interest are the Winslow Crocker house, the John Thacher house (1680), and the Yarmouth Historical Society building. Government is by town meeting. Population: 21,174.

MARTHA U. WHITE.

**YARMOUTH**, town, Nova Scotia, Canada, seat of Yarmouth County, situated on the Bay of Fundy and the Atlantic Ocean, in the extreme southwest part of the province, opposite the State of Maine and 140 miles southwest of Halifax. It is served by the Canadian National and Canadian Pacific railways and has bus, air, and steamship services, including a car ferry to Bar Harbor, Me. Yarmouth is a cool and healthful resort with scenic drives, surf bathing, boating, fishing, and hunting. It is also a port of entry and the chief commercial and shipping center of Nova Scotia's three western counties; at one time it was the greatest ship-owning port per capita in the world. Fishing and lumbering are major industries, with some manufacturing. Strawberries and Irish moss are also shipped from here. Yarmouth was founded in 1761 by colonists from Sandwich.

Mass. Many of the earlier French settlers banished in 1755 found their way back in 1767. In 1785, following the American Revolution, Loyalists arrived from New York and other United States cities. The town was incorporated in 1890. Population: 7,475.

WALTER J. KONTAK.

**YARMOUTH, Great, or YARMOUTH**, county borough, England, in Norfolk County, 22 miles east of Norwich. The town is built on a narrow slip of land some three miles long between the North Sea and Breydon Water, formed by the silting up of the mouths of the rivers Yare and Bure and the diversion of their combined waters to the south, where they enter the sea between stout timber piers erected in 1613. The diverted rivers form Yarmouth Harbour, which is connected by bridges with Southtown and other places west and north.

Yarmouth, with its suburb of Gorleston, is a highly popular seaside resort with excellent beaches, piers, theaters, and other provisions for amusement. Its position at the confluence of the Yare, Waveney, and Bure rivers, the three main streams of the Norfolk Broads, makes it an important center for boating and freshwater fishing. Yarmouth has also been noted for its North Sea herring fishery, producing a well-known type of cured herring called "bloaters." The townspeople are employed in a variety of other industries as well, including boatbuilding, brewing, engineering, and food processing.

The first charter was granted by King John in 1200. The old town was originally confined on three sides by high stone walls built in the 14th century, of which the Northwest, Southeast, and Blackfriars towers remain. A result of this restriction was the building of 145 extremely narrow lanes or "Rows," in which the homes of the wealthy burgesses were built. Yarmouth was heavily bombed during World War II, and most of the Rows were destroyed. Bombs also caused the near destruction by fire of the Church of St. Nicholas, founded in 1101, the largest parish church in England. Fortunately the walls remained reasonably intact, and it was possible to rebuild the church after the war. The 14th century Tolhouse, the seat of government in medieval times, was likewise severely damaged and subsequently restored. The Old Merchants' House has been restored and is open to the public as a museum. Population (1961): 52,970.

H. GORDON STOKES.

**YARMULKE**, yär'mäl-kə, the Yiddish name for the skullcap worn by Orthodox Jewish men at all times. The word is probably derived from Turkish *yagmurluk*, through Slavic *yarmulka*, though some derive it from Medieval Latin *armucella*. The Jewish custom of wearing a head covering developed gradually, and only in the 17th century did religious authorities rule that during prayers one must cover one's head. Thereafter the custom rapidly expanded, and the wearing of a head covering (in the shape of the yarmulke) became an established religious duty. The term "yarmulke" was used in Russia, the Ukraine, and Rumania, while in Poland and to the west the skullcap was called *kapl* or *kapele*.

RAPHAEL PATAL.

or machine, or for thread used in sewing. Its first development came about accidentally when primitive man observed the natural twining of vines and stems. This principle was first adapted in making cords for fastening crude stone implements to handles or hafts, and for fishnets, snares, and ropes used to carry heavy objects or to lash posts together in building dwellings. In time the principle of twisting was advanced to the manufacture of spun yarn and woven cloth. Wherever prehistoric burials or house sites have been discovered, traces of spinning and weaving have been found, such as the scraps of yarns, textiles, and spindle whorls found in the Neolithic lake dwellings.

Almost all yarn is spun, although at times very long filaments, as in silk and nylon, are unspun or show almost no identifiable twist. The process of spinning that forms yarn may be divided into three parts: (1) drawing out, or arranging the fibers in as nearly parallel a form as possible; (2) twisting to hold the drawn-out fibers in position; and (3) winding. In the simpler forms of hand spinning, still in use in many parts of the world, these three processes are performed separately so that intermittent spinning is the rule. The advance in machines in the late 18th and 19th centuries made it possible to do spinning in one continuous process.

Yarns vary greatly according to the fiber used, the number of twists per inch (varying from 3 to 80), the diameter of the fiber or filament used, and the ply of the yarn (single, double, or multiple). Yarns may be smooth and shiny or rough and dull, or they may be used in combination. A fine smooth shiny yarn, for example, may be spun or plied together with a rough and heavier yarn to give a different effect to the finished cloth. Gold, silver, or some other metallic material, cut into very narrow strips and used either flat and alone or applied with some adhesive to paper (as in China) or to some other substance such as leather (as in medieval Europe), may be wound around a core of some fiber like silk or linen. Different colors of yarn may be plied together, and different fibers may be spun together in the same yarn. Synthetic fibers are frequently spun together with some natural fiber such as cotton or wool.

Yarns are spun in either of two directions: clockwise, known as the Z twist; or counterclockwise, known as the S twist. When yarns are plied (sometimes up to 12 or more strands together), the individual strands or single yarns are generally used partly in S twist and partly in Z twist. In general single-ply yarns are rather soft and somewhat fuzzy and only occasionally are used for the warp (vertical yarns) in a woven fabric. Their most frequent use is for the weft (horizontal yarns), where they do not undergo the constant friction of the beater of the loom. Multiple-ply yarns are stronger and so more useful for the warp of a fabric, but they are equally suitable for use as weft.

In measuring yarn the number or count is based on the relationship of the length of the yarn to a unit of weight. If the metric system is used, the numbering of the yarn is based on the number of meters to one gram of yarn. For example, in a No. 8 yarn there are 8 meters of yarn to 1 gram of weight. In numbering cotton, linen, woolen, and worsted yarns, the English system is generally employed. In this system of counting, standard No. 1 yarns have the follow-

**YARN**, yärn, a fiber or fibers spun for use in the manufacture of knitted or woven fabrics by hand

ing number of yards per pound:

Cotton	840 yards
Linen	300 yards
Woolen	256 yards
Worsted	560 yards

Higher numbers represent multiples of these lengths per pound; for example, No. 8 cotton has 6,720 yards per pound. Thus, the higher the number, the finer the yarn. Silk and some of the synthetics such as nylon are measured according to the French system, known as the denier system, which calculates the weight of a unit of length instead of the length of a unit of weight; hence the higher the number, the coarser the yarn. The ply of a yarn is also shown by the number; 8/2 signifies a size 8 yarn 2 plied. Plying of yarns reduces their length, as do dyeing and bleaching. All these factors must be considered when planning a weaving project.

The fibers of which yarns are composed are classified in two main groups: natural, and man-made or synthetic. The best-known natural fibers and yarns are linen, cotton, silk, and wool, although many less commonly used fibers such as alpaca, Angora rabbit, camel's hair, llama, raccoon, and even dog hair may be used in spinning yarns. Man-made fibers and yarns began to be used in the early years of the 20th century and by the middle years of the century had become legion. They include acetate, acrylic, polyester, polyvinyl, rayon, glass, and fibers made from a protein base from such substances as skim milk, seaweed, peanuts, and soybeans. All of these fibers vary according to trade names, although the processes of manufacture are much the same for each basic type. The tensile strength and easy washability of many man-made yarns, even when combined with natural fibers, have made them very popular for both hand and commercial weaving.

See also TEXTILE FABRICS; TEXTILE MACHINERY; TEXTILES, SYNTHETIC; COTTON; LINEN; SILK AND THE SILK INDUSTRY; WOOL; WEAVING, HAND LOOM.

JEAN LOPARDO.

**YARNELL**, yär-něl', **Harry Ervin**, American naval officer: b. near Independence, Iowa, Oct. 18, 1875; d. Newport, R.I., July 7, 1959. He graduated from the United States Naval Academy in 1897 and served during the Spanish-American War. By World War I he was a captain, during part of it on the staff of Adm. William S. Sims. After receiving aviation training, Yarnell became the first commanding officer of the aircraft carrier *Saratoga* (1927-1928). He was then commissioned rear admiral and served for three years as chief of the Navy's Bureau of Engineering and as naval adviser at the London Disarmament Conference of 1930. From 1931 to 1933 he was commander of aircraft in the Pacific Fleet and for the next three years commandant at Pearl Harbor. As commander in chief of the United States Asiatic Fleet (1936-1939) during the Japanese invasion of China, with only a slender force at his disposal, he displayed courage and diplomacy in maintaining American interests in the face of Japanese truculence and isolationism at home. After the gunboat *Panay* in his command was sunk by Japanese aircraft in the Yangtze River on Dec. 12, 1937, Yarnell gained an apology and indemnity from Japan. He retired with the rank of rear admiral on Nov. 1, 1939, one of the able leaders who prepared the United States Navy for the

great test of World War II.

JOHN D. HAYES.

**YAROSLAV I**, yŭ-rŭ-sláf' (baptismal name **GEORGE**; called **THE WISE**), grand duke of Kiev: b. about 982; d. Kiev, 1054. His father, Vladimir the Great (see **VLADIMIR**), made him vice regent of Novgorod, where Yaroslav attempted to set himself up as an independent ruler in 1014-1015. On Vladimir's death in the latter year, Yaroslav became involved with his half brother Sviatopolk the Accursed in a contest for the Kievan throne. Although Kiev itself was briefly occupied (1017-1018) by Sviatopolk's ally Boleslav (Boleslas) I of Poland, the war ended in a victory for Yaroslav, who assumed the throne in 1019. He next had to cope with several other brothers, especially Mstislav of Tmutorokan and Chernigov. After Mstislav won the Battle of Listven (1024), the two brothers divided their spheres of influence along the Dnieper River (1025), with Kiev and the territories of the right bank falling to Yaroslav. On Mstislav's death without issue (1036), Yaroslav became undisputed ruler of all Russia.

Yaroslav warred against the Baltic and Finnish tribes, the Poles, the Turkic Pechenegs of the Steppe (ending in decisive victory in 1036), and Byzantium (the unsuccessful plundering raid of 1043). The most notable achievements of his reign, however, were internal. The Christian faith established by his father (987/988), was propagated through the spread of book learning (Kievan commission for translations from Greek into Slavic); and church architecture attained a high level. Among the outstanding structures of the period were the monasteries of St. George and of St. Irene and the Church of the Annunciation, in Kiev; the Church of St. Sophia (1045), in Novgorod; and above all, the magnificent Church of St. Sophia (c. 1037), in Kiev, containing the best-preserved examples of early 11th century Byzantine art to be found anywhere. Letters flourished also, as witnessed by Metropolitan Hilarion's *Sermon on Law and Grace* (c. 1040/1050), a work equal in quality to its Byzantine models. Some laws were written down: the core of the first recension of the "Russian Law" (*Pravda Russkaya*) may go back to Yaroslav's time. Under Yaroslav the Kievan state lived through one of its two periods of greatness.

Judging by Hilarion's *Sermon* and the St. Sophia mosaics with their Greek inscriptions, Kiev's orientation under Yaroslav was Byzantine. This, however, is only part of the truth. Byzantium was defied militarily, and perhaps even ecclesiastically since Hilarion was a native of Kiev and was elected metropolitan there. Marriage alliances in Yaroslav's family were often Western: his wife was the Swedish princess Ingigerdr Irene, and his daughter Anna was married to the French King Henry I. The German Emperor Henry II was Yaroslav's ally in 1017. Contacts with Scandinavia continued: Yaroslav survives in Norse sagas, and kings of Norway spent some time at his court, which must have had an international flavor. His sarcophagus and skeleton are preserved in the Church of St. Sophia at Kiev.

IHOR ŠEVČENKO.

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**YAROSLAVL**, yŭ-rə-sláv'al-yə, oblast, USSR, in the central industrial region of the Russian SFSR, northeast of Moscow Oblast. Its area of 14,200



square miles, drained by the upper Volga River, lies in the forest zone, with infertile gray-brown soils. The oblast produces peat, lumber, and building stone, and its farms yield flax, potatoes, vegetables, and dairy products. During 1937-1941 dams were constructed on the Volga at Uglich and Rybinsk, the latter leading to the formation of the Rybinsk Reservoir. Small hydro-electric stations are in operation at both sites. Formerly a center of linen milling established in the 18th century, the oblast now has diversified industries including the manufacture of machinery and automobiles, shipbuilding, and chemical plants. Fisheries are maintained on the Volga River and at the Rybinsk Reservoir. The oblast was formed in 1936 out of Ivanovo Oblast. Its capital is the city of Yaroslavl (q.v.). Pop. (1961) 1,392,000.

W. A. DOUGLAS JACKSON.

**YAROSLAVL**, city, USSR, in the Russian SFSR, on the upper Volga River, about 150 miles north-east of Moscow. The city, capital of Yaroslavl Oblast, forms part of the central industrial region, of which Moscow is the core. Yaroslavl is situated at the junction of the Moscow-Archangel and Rybinsk-Kostroma railway lines. A river port, the city stretches about 15 miles along the right bank of the Volga where the latter is joined by the small Kotorosl River. Yaroslavl is noted for its manufacture of synthetic rubber, rubber tires, resin-ashbestos materials, chemicals, and trucks. It also produces machinery, cotton and linen textiles, and foodstuffs. An oil refinery was opened in 1960, and on the left bank of the Volga there is a thermal-electric plant, run on peat.

A kremlin was built at the mouth of the Kotorosl sometime between 1010 and 1025 A.D. to strengthen the defenses of the Kievan Russian state against the raids of the Pechenegs, and the town was named after Yaroslav the Wise, prince of Kiev. Despite its river location, Yaroslavl's development was slow during the 11th and 12th centuries, but it became an important center of religious culture. In one of Yaroslavl's monasteries the manuscript of the 12th century tale, *The Word of the Campaign of Igor*, was found.

In 1238 Yaroslavl was sacked by the Mongol-Tatars in their sweep over much of Kievan Russia. Two centuries later, in 1463, Yaroslavl accepted the overlordship of the rising Muscovite principality.

When the Mongol-Tatar yoke was finally lifted, Yaroslavl's fortune began to improve. The city's position on the upper Volga afforded it great commercial advantages, particularly when, in the latter 16th and 17th centuries, the Volga River became a major trade artery with Central Asia and the East. The development of trade between west European countries and Muscovy by way of the White Sea also benefited Yaroslavl, which lay on the cart road connecting Archangel with Moscow. One of the famous churches built during this period is the Church of St. John Chrysostom in Korovniki (1649-1654), which shows a blending of Eastern and Western styles; its use of colored tiles suggests a Dutch influence.

The opening of the Gulf of Finland and the subsequent building of St. Petersburg by Peter the Great at the beginning of the 18th century siphoned off the trade that had hitherto passed through Yaroslavl. In the mid-19th century the population was only about 27,000. During the period of Soviet rule, however, the city has once more enjoyed a rapid growth. It possesses a philharmonic orchestra and a fine dramatic theater, founded in 1750. Pop. (1959) 407,000.

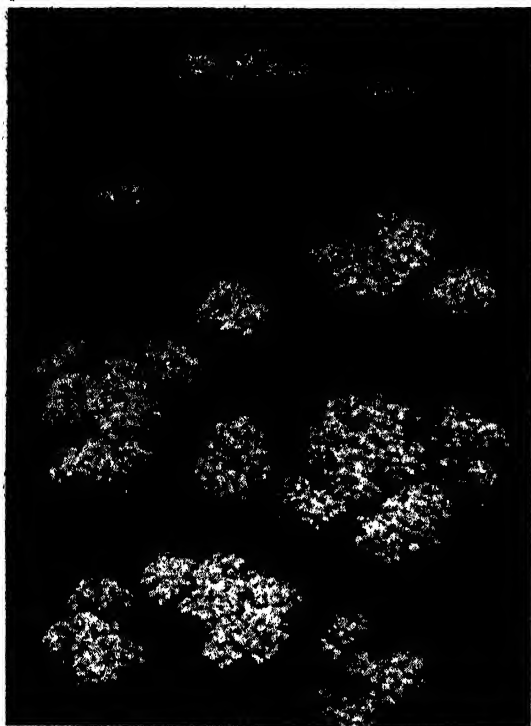
W. A. DOUGLAS JACKSON,  
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**YARRA RIVER**, yār'a (formerly YARRA YARRA RIVER), river, Australia, in southern Victoria. It rises in the Great Dividing Range and flows 115 miles in a westerly direction into Hobson's Bay, the northern arm of Port Phillip Bay. The city of Melbourne is situated on its banks, near the mouth. The upper reaches of the river are noted for their scenic beauty and constitute a popular vacation area. The Upper Yarra Dam, completed in 1957, is 64 miles above Melbourne. The river was discovered by Charles Grimes in 1803 and named by John H. Wedge in 1835. The name means "running water" in the aboriginal language.

An old city with many historic sites, today Yaroslavl is a growing part of an industrial region.

Sovfoto





Yarrow (*Achillea millefolium*), or milfoil, is a weed commonly found in fields and on roadsides.

**YARROW**, yar'ō, a perennial plant, *Achillea millefolium*, of the composite family (Compositae). Yarrow (or milfoil) grows to a height of 3 feet (1 meter), has small white or pink flowers borne in flat-topped clusters up to a foot (0.3 meter) across, and aromatic fernlike leaves, which are 1 to 6 inches (2.5 to 15 cm) long and are alternate on the stem. Yarrow is native to Eurasia but occurs as a weed elsewhere. The plant spreads by seeds and by underground runners. It can be a pernicious pest in lawns, and cattle that eat it may yield off-flavored milk. Pink-flowered yarrow is grown as an ornamental. Yarrow is used to some extent in folk medicine; research indicates that it may have value for its hemostatic and anti-inflammatory properties. *Achillea*, the genus to which yarrow belongs, was named for Achilles, who reputedly discovered the medicinal virtues of the plant. Some botanists consider certain native North American members of *Achillea*, for example *A. lanulosa* and *A. borealis*, to be varieties of *A. millefolium*.

JOHN W. THIERET  
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**YARROW RIVER**, yar'ō, a river in the Borders region of Scotland, rising just northeast of the town of Moffat. The Yarrow River, also called Yarrow Water, flows in a generally east-northeasterly course for 24 miles (38 km) through the Loch of the Lowes and St. Mary's Loch. It enters Ettrick Water, a tributary of the river Tweed, about 2 miles (3 km) southwest of Selkirk town. Noted for its beauty, the river has been celebrated in poems by Sir Walter Scott, William Wordsworth, and James Hogg, who was known as the "Ettrick Shepherd."

**YASNAYA POLYANA**, yāz'-nə-yə pāl-yā'nə, the former home of the Russian writer Leo Tolstoy, 115 miles (185 km) south of Moscow. The name means "clear glade." The present grounds, which are open to the public, form part of a larger estate that Tolstoy inherited from his mother. The chief point of interest is the house where Tolstoy lived during his marriage (1862–1910). His unmarked burial place lies in the woods nearby. Also on the grounds are his mother's family mansion and a literary museum occupying a former house that Tolstoy had converted into a village school.

**YASTRZEMSKI**, yə-strem'skē, Carl (1939– ), American baseball player, who established American League records for most games (3,308) and times at bat (11,988). His 23 seasons with the Boston Red Sox set a major league record for service with one team.

Yastrzemski was born in Southampton, N.Y., on Aug. 22, 1939. Signed by Boston in 1959 after a year at Notre Dame, "Yaz" had two outstanding seasons with the Raleigh (N.C.) and Minneapolis farm clubs. He was then given the task of taking over in left field for Ted Williams, who had retired in 1960. By 1963 he won his first of three batting titles, with .321, and established a reputation as a brilliant outfielder, leading to seven Gold Glove awards. He was also the AL batting leader in 1967, with .326, and in 1968, "the Year of the Pitcher," with .301.

In 1967 he led the Red Sox to their "Impossible Dream" pennant following a ninth-place finish in 1966. He won the Most Valuable Player award and was one of a select group in history to achieve a Triple Crown, leading the AL in batting average and runs batted in (121) and tying for the lead in home runs (44).

Although he seldom approached his 1967 success, Yaz made the AL All-Star team 18 times. He was also the first in AL annals to amass combined career totals of 3,000 hits (3,419) and 400 home runs (452). He hit over .300 six times, with a lifetime average of .285. Yastrzemski was elected to the Hall of Fame in 1989.

MARTIN APPEL, Coauthor of  
"Baseball's Best: The Hall of Fame Gallery"

**YATES**, Richard, American political leader: b. Warsaw, Ky., Jan. 18, 1815; d. St. Louis, Mo., Nov. 27, 1873. He received the first diploma issued at Illinois College in Jacksonville, Ill. (1835), studied law at Transylvania University, and was admitted to the bar in 1837. He then practiced law in Jacksonville, was a member of the state legislature during most of the 1840's, and from 1851 to 1855 was a Whig member of Congress. A staunch opponent of slavery, Yates joined the new Republican Party and was governor of Illinois throughout the Civil War, from 1861 to 1865. In this key position he gave invaluable support to President Abraham Lincoln's war policies, working tirelessly to mobilize the full resources of the state for the Union military effort. When the Peace Democrats in the Illinois General Assembly adopted a resolution calling for a negotiated peace, Yates dismissed the legislature (1863). He also had the distinction of giving Ulysses S. Grant his first Civil War commission in 1861. After the war, as a United States senator (1865–1871), Yates aligned himself with the Radical Republicans and voted to impeach Andrew Johnson.

**YATES, Robert**, American political leader and judge: b. Schenectady, N.Y., Jan. 27, 1738; d. Albany, Sept. 9, 1801. After studying law, he practiced in Albany, where he earned a reputation as a solid though not brilliant attorney. When conflicts developed with Britain, Yates unhesitatingly chose the colonial side. He pushed for independence at the New York provincial congresses of 1775 and 1776, was a member of the Committee of Safety chosen by the latter, and in 1777, after helping to prepare the first state constitution, became a justice of the New York Supreme Court. Later, in the 1790's, he served as chief justice of the court.

Yates is chiefly remembered as an anti-Federalist, joining his friend George Clinton after the War of Independence as an advocate of states' rights as against national power. This was the view he represented as a delegate to the Constitutional Convention in Philadelphia in 1787. When his colleague Alexander Hamilton asked for greater powers for the federal government, Yates urged that authority remain with the states. Leaving the convention before adjournment, he opposed ratification of the new Constitution on these grounds; but when the Hamilton forces won out at the New York State ratification convention, Yates accepted defeat gracefully. "It would be little short of treason," he said, to continue resistance after the Constitution had been adopted.

Taking this position, Yates drifted away from Clinton. In 1789 he ran against the latter for governor, with Hamilton's support. Defeated in this contest, he lost again in 1795, being beaten narrowly by John Jay. Thereafter he faded gradually from the political scene. His notes on the Constitutional Convention of 1787 were published in 1821.

FRED HARVEY HARRINGTON  
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**YATSUSHIRO**, yā-tsōō-shē-rō, a city in Japan, situated on the alluvial fan of the Kuma River, 22 miles (35 km) by rail south of Kumamoto, in Kumamoto prefecture, on the island of Kyushu. Originating as a transportation and traffic center on the Kuma River during the feudal period, Yatsushiro became a castle and local market town between the 17th and 19th centuries. It grew into an industrial center with the advent of large modern factories: a hydraulic cement plant was established in 1888, a pulp and paper mill in 1924, a rayon textile factory and a brewery in 1937, and a ramie textile plant after World War II, all of which were attracted by the plentiful supplies of raw materials and labor that were available in the area. The city is famous for its Kodayaki porcelain, first made by Korean potters who came to Japan during the 16th century. Population: (1985 census) 108,790.

GEORGE H. KAKIUCHI  
*University of Washington*

**YAVAPAI INDIANS**, yā'və-pī, a North American Indian tribe, whose language belongs to the Yuman language family. The Yavapai formerly inhabited lands around the Verde River, from Bill Williams Mountain to the Salt River, in central and west central Arizona. The meaning of their name is unclear.

In 1582 the Spanish explorer Antonio de Espejo visited them and estimated their population at 1,500. The popular name Mojave Apache has

been applied to them and is a cause of considerable confusion, since they are in no way related to the Apache peoples: the appellation originally arose from their warlike disposition. The Yavapai offered resistance all through the period of early American occupancy of their area. As a result they were forcibly removed to the San Carlos Reservation in 1875, but gradually drifted back to their homeland, centering on the abandoned Camp (now Fort) McDowell Military Reservation. The United States turned this territory over to the tribe in 1903.

In 1910, Camp Verde was established for Yavapai use; by 1916 nearby Middle Verde had been added to their lands. Another reservation was established at Prescott in 1935 and expanded in 1956, and in 1969 a smaller tract at Clarksdale was added to Yavapai territory. Longstanding U.S. government plans to build the Orme Dam, which would have resulted in the flooding of a large portion of the Fort McDowell reservation, were finally abandoned in the 1980's.

FREDERICK J. DOCKSTADER\*  
*Author of "Great North American Indians"*

**YAWATA**. See KITAKYUSHU.

**YAWL**, yōl, a small ship's boat, usually propelled by four or six oars and schooner-rigged. The name is also applied to a jolly boat, a small fishing boat, and to a sailboat similar to a sloop but also carrying a small sail, called the mizzen, at the stern.

**YAWS**, yōz, an infectious tropical disease, also called pian or frambesia, prevalent in the West Indies, South Pacific islands, Africa, and South America. It is caused by a spirochetal microorganism (*Treponema pertenue*) similar to that producing syphilis. The disease is usually acquired early in childhood by direct contact with the open infectious ulcers of other individuals with this illness. It is associated with poor personal hygiene and in some instances is thought to be spread by flies. The disease is similar in many respects to syphilis, and some authorities believe that the two diseases were at one time identical but became modified by environmental factors. Both illnesses produce a positive blood test with the Wassermann reaction, and both respond to treatment with penicillin. In humans and experimental animals the presence of one disease usually produces immunity to the other disease.

The clinical manifestations of yaws usually appear after an incubation period of approximately one month. The initial lesion, the mother yaw, consists of a small growth, often on the legs, which later ulcerates and then heals with scar formation. Two or three months later a generalized skin rash develops, consisting of large lesions over the skin of the face, neck, and extremities. This skin eruption eventually heals spontaneously, but penicillin treatment produces rapid improvement. Yaws often appears on the soles of the feet, producing painful ulcerations known as "crab yaws." Several years after the onset of infection, the disease, if untreated, may produce destructive changes in the bones of the hands, arms, and legs. The bridge of the nose may be destroyed, and severe ulcerative changes may occur in this area.

The diagnosis of yaws may be made by the characteristic appearance of the skin eruptions,

but the spirochetal organism is readily demonstrated in the infectious ulcerations. The Wassermann and other blood tests for syphilis are usually positive. Treatment of the disease consists of a single or several injections of penicillin. This antibiotic produces almost complete recovery in the great majority of patients and is the treatment of choice. An extensive program for the treatment of large population groups with this illness has been carried out throughout the world by the World Health Organization.

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**YAZD**, yäzd, a town in central Iran, about 410 miles (655 km) southeast of Teheran. It lies at an elevation of about 4,000 feet (1,200 meters) in a long valley bordered by high ranges. Its name is an ancient Iranian word for "God." The town is situated on a major highway leading from Teheran to the extreme southeast of Iran and on the line of a railway that parallels the highway. A modern airport is adjacent.

Yazd (Yezd) is the agricultural center of a district that is generally far from fertile. Rainfall is so scanty that all crops must be irrigated. Water for this purpose is brought in underground canals from the snowcapped ranges in the area or, more recently, derived from the flow of deep wells. There are many orchards in the surrounding country, and cotton is also grown. For centuries fine carpets, silk piece goods, and delicate shawls have been woven on family looms in the town. Copper is mined and processed in the vicinity.

Yazd is dominated by the lofty twin minarets that flank the entrance to the old congregational mosque. Hundreds of tall wind towers, which direct the prevailing breezes into the houses, resemble minarets and have brought Yazd the nickname of the "abode of devotion."

The site is a very ancient one, famous in Sasanian times (3d to 7th centuries A.D.), and after the conversion of Iran to the Muslim religion it remained a stronghold of the older Zoroastrian faith. Its colony of Zoroastrians, renowned as gardeners and irrigation experts, is the largest in the country. Their dead are exposed to the elements within high-walled, circular structures. Population: (1986 census) 234,003.

DONALD NEWTON WILBER  
Coauthor of *"Iran Past and Present"*

**YAZIDIS**, yä'zə-dēz, a religious sect of Kurdish-speaking people, centered mainly in the Mosul area of Iraq and around Kilis and Gaziantep in southern Turkey. Their number is estimated at between 40,000 and 70,000. Modern scholars believe the sect is of Muslim origin, descending from supporters of the Umayyad caliph Yazid I (reigned 680–683). The Yazidis (Yezidis) are popularly known as devil worshippers, but this is a misnomer; it would be more correct to think of them as angel worshipers, since they consider Satan (Malak Taus) to be an angel who has fallen but will be restored for his repentance. The Yazidi scriptures are in Arabic, but the tradition is passed on in Kurdish, the language of prayer. The religion is synthetic, including Judaic, Christian, Islamic, and Zoroastrian elements. Saturday is the day of rest, Wednesday the holy day. There is also an annual pilgrimage to the tomb of Sheikh Adi (about 1160), the Yazidis' major saint, north of Mosul.

The Yazidis remain aloof from their neighbors and seek no converts. They are mostly farmers, although nomadic Yazidi tribes exist. Their society is divided into laity and clergy, the latter hierarchically organized. Contrary to popular belief, the Yazidis value cleanliness and are of high moral caliber.

NORMAN ITZKOWITZ, Author of  
*"Ottoman Empire and Islamic Tradition"*

**YAZOO CITY**, ya'zōo, a city in west central Mississippi, the seat of Yazoo county, on the Yazoo River, about 40 miles (64 km) northwest of Jackson. Among the city's manufactures are cottonseed oil, lumber products, fertilizer, and clothing. An oil field was discovered nearby in 1939, and the city has an oil refinery.

Founded in 1824 as Hanan's Bluff, the city prospered as a river port and was incorporated as Manchester in 1830; the name was changed to Yazoo City in 1839. During the Civil War it was the site of a Confederate navy yard and was twice burned though not held by Union forces in 1863. Population: 12,427.

**YAZOO LAND FRAUD**, ya'zōo, a transaction by which, in 1795, the Georgia legislature sold approximately 35 million acres (14 million hectares) of land, situated in what are now the states of Alabama and Mississippi, to four land companies for \$500,000. The sale became a national scandal when it was learned that it had been procured by wholesale bribery of the legislators.

A new legislature passed an act in 1796 rescinding the sale and ceremoniously burned the 1795 act. In litigation over the validity of titles purchased from others who had taken title from the original grantees, the U.S. Supreme Court ruled in 1810, in the historic case of *Fletcher v. Peck* (6 Cranch 87 [1810]), Chief Justice John Marshall writing the opinion, that the act of 1796 rescinding the 1795 grant was unconstitutional. The case was a constitutional landmark for the following reasons: (1) it was the first instance in which the U.S. Supreme Court held a state statute invalid because of conflict with the U.S. Constitution; (2) it established that a public grant is a contract subject to the provision in the federal Constitution prohibiting states from impairing the obligation of contracts; and (3) in connection with a question as to the validity of the 1795 act, it rejected the principle that a legislative act can be declared invalid because of corrupt motives of legislators who enacted it. Georgia meanwhile had ceded its interest in the Yazoo lands to the United States in 1802. The controversy was finally resolved by an appropriation of over \$4 million by Congress in 1814 to indemnify parties claiming lands pursuant to the Georgia act of 1795.

C. DOUGLAS SANDS, University of Alabama

**YAZOO RIVER**, ya'zōo, a river in west central Mississippi, formed by the junction of the Tallahatchie and Yalobusha rivers near the city of Greenwood. It flows 189 miles (304 km) in a southwesterly direction, meeting the Mississippi River at Vicksburg. The Yazoo is navigable. The area between the Mississippi on the west and the Yazoo and its tributaries on the east—about 65 miles (105 km) wide and 200 miles (322 km) long from Memphis, Tenn., to Vicksburg—is known as the Yazoo Delta. Subject to periodic floods, it is famous for long-staple cotton.

**YEADON**, yá'dən, borough, Pennsylvania, in Delaware County, immediately west of Philadelphia, of which it is a residential suburb. The place was named Yeadon in 1870 after Yeadon Manor, the residence of a prominent citizen, who named it for the home town of his parents in England. Points of interest are the Enoch Bonsall House (1763) and the Palmer Homestead (1774). Yeadon was chartered as a borough in 1894. Government is by mayor and council. Population: 11,980.

GERTRUDE M. BOSSARD  
Yeadon Public Library

**YEAR**, yîr, a unit of time intended to equal the period of revolution of the earth around the sun. Prior to 4000 B.C. the Egyptians established the length of the year as 365 days by counting the days that elapsed between two successive heliacal risings of the star Sirius; that is, two successive appearances of Sirius just before sunrise, each occurring after a period of invisibility caused by its nearness to the sun. Astronomers distinguish several kinds of year, of which three—the tropical, sidereal, and anomalistic—are most common.

The *tropical year*, also called *solar year* or *equinoctial year*, is the year to which the Gregorian calendar is adjusted. It is the interval between two successive returns of the sun to the vernal equinox and is approximately equal to 365.24220 mean solar days, or 365 days 5 hours 48 minutes 46 seconds. Since 1956 the tropical year has been the interval in terms of which the second, the fundamental unit of time in the several systems of units employed in physics and engineering, is defined. In that year the International Committee on Weights and Measures redefined the second as  $1/31,556,925.9747$  of the tropical year for Dec. 31, 1899 (called January 0, 1900, in astronomical literature) at 12 hours ephemeris time. It was necessary to use a specific date because the length of the year is not precisely constant: the tropical year is slowly decreasing in length, while the sidereal and anomalistic years are slowly increasing. The rate of change, however, is less than 1 second per century.

The *sidereal year* is the average period of revolution of the earth with respect to the fixed stars; its duration is 365.25636 mean solar days. The *light-year*, a unit used to express stellar distances, is the distance light travels in 1 sidereal year; it is equal to  $5.879 \times 10^{12}$  miles. The *anomalistic year* is the average interval between successive closest approaches of the earth to the sun; its length is 365.25964 mean solar days.

The calendar year for the Gregorian calendar consists of 365 days (366 in leap years) and is divided into 12 months. It begins on January 1 and ends on December 31. Since the length of the tropical year is nearly  $365\frac{1}{4}$  days, it is necessary once every 4 years (with certain exceptions; see **LEAP YEAR**) to add a day to the calendar year. This day, which falls on February 29, is known as leap day.

See also **CALENDAR**—*The Measurement of Time*; **CHRONOLOGY**; **DAY**; **TIME**—*Measurement and Determination of Time*.

**YEARDLEY**, yârd'lê, Sir George, English governor of Virginia: b. London, England, c. 1587; d. Jamestown, Va., buried Nov. 13, 1627. He was trained as an officer with the English Army in the Netherlands and in 1609 sailed for Virginia as

captain of the guard for Sir Thomas Gates. He was appointed to the council in 1611 and served as acting lieutenant governor from April 1616 to 1617, when he returned to England. On Nov. 18, 1618, he was commissioned governor and captain general of Virginia, succeeding Lord De La Warr, and on November 24 was knighted by James I. The Virginia Company instructed him to divide the land by a set formula and to set up a civilian government.

Yeardley reached Jamestown in April 1619 and on July 30 organized the General Assembly of Virginia, the first representative assembly in the New World. Before his term expired, he asked for a successor in order to devote his time to private business. He became a member of the council under Sir Francis Wyatt in November 1621 and marshal in 1622. In 1625, the year after the charter of the Virginia Company was annulled and Virginia became England's first crown colony, Yeardley went to England to petition the king to let Virginia keep her form of government. He returned to Jamestown in April 1626 with a commission as royal governor to succeed Wyatt and continued in office until his death. He was buried on Nov. 13, 1627.

NORA MILLER TURMAN  
Author of "George Yeardley"

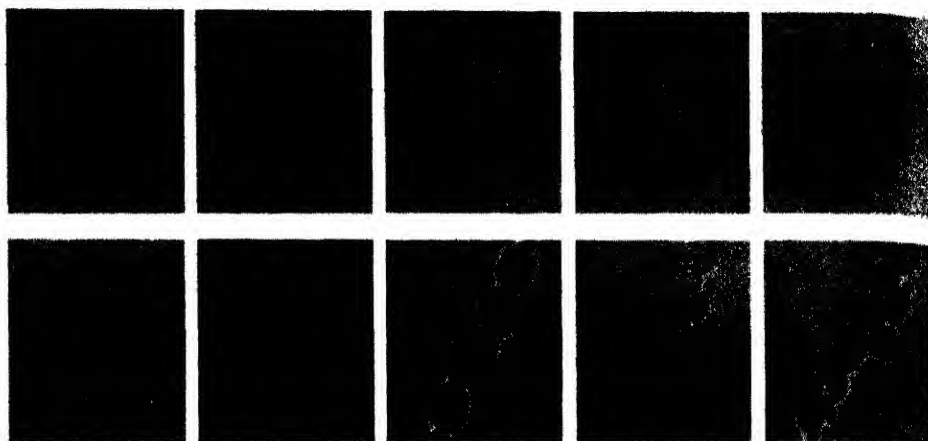
**YEASTS**, yêsts, microscopic, single-celled, colorless plants. They are true fungi, with round or oval cells that are much larger than bacteria. The characteristic method of reproduction is budding, in which a small swelling occurs at the edge of the cell, gradually enlarges, and at maturity separates from the parent cell by constricting at its base. In some species, buds are slow in breaking free and thus form clusters of cells. The spores produced by true yeasts are a means of survival rather than reproduction. Definite classification of the yeasts and imperfect yeasts is still unsatisfactory from a botanical standpoint, and the term "yeast" is often used to refer to species in both groups.

Yeasts, widely distributed in nature, are found on the fruit and leaves of plants and in the soil. Nearly all yeasts adapted to use by man are in one genus, *Saccharomyces*, with *S. cerevisiae* the most prominent species. Uses of yeasts are based on their ability to ferment sugar solutions or their nutritional and medicinal values.

Fermentation processes are as old as history and were highly developed before the advent of scientific methods. The modern industries of bread making, brewing, spirits and industrial alcohol manufacture, and wine making, however, owe their foundations to the work of Louis Pasteur (q.v.) in the mid-19th century. The food, feed, and medicinal uses of yeasts were found later as knowledge of vitamins and metabolism unfolded. They have been widely hailed as therapeutic agents. The quantities of yeasts grown annually are measured in the hundreds of million pounds.

The procedures for growing yeasts are fundamentally the same in each industry. A pure culture is obtained by isolating a single yeast cell and growing it on a nutrient medium consisting of sugars (molasses, starchy grains, potatoes), a source of nitrogen (ammonia, grain steepwater), minerals, and water of controlled acidity. As growth proceeds, the culture is transferred to successively larger batches of medium until the final batch often exceeds 100,000 gallons. When growth is completed, the yeast cells are separated





The Distillers Company Ltd

Photomicrographic sequence of yeast cell budding. Cells are nurtured on sugars, a nitrogen source, minerals, water.

from the spent medium.

Yeasts grown for bread making, food, feed, and medicinal purposes are the primary product of the fermentation process and produce little alcohol. The spent medium is the byproduct and is discarded after centrifuging out the yeast cells. Yeasts grown during fermentations for beer, ale, spirits, wine, and industrial alcohol, however, are the byproducts, while the spent medium becomes the final consumer product.

**Types.**—*Baker's yeast* is a strain of *S. cerevisiae* grown on a medium of molasses and ammonia or molasses and grain extracts. The yeast rapidly ferments the sugars derived from the starch in the flour to produce carbon dioxide gas which leavens the dough.

*Brewer's yeasts* are strains of *S. cerevisiae* that slowly ferment the extract of malt, cereals, and hops to produce beer (bottom-fermenting yeast) or ale (top-fermenting yeast). After separation from the spent medium, these yeasts are dried for animal feed or refined before drying for use in food and medicine.

*Spirits and industrial alcohol yeasts* are strains of *S. cerevisiae*, and sometimes other species, that ferment molasses, grains, or other sugary material. After separation from the spent medium, yeast and fermentation residues are dried together for animal feed.

*Wine yeasts* are strains of *S. cerevisiae* var. *ellipsoideus* that ferment grape juice. Here the yield of yeast is too small to be salvaged economically.

*Food (and feed) yeast* production, stimulated by shortages in two world wars, reaches large proportions in Europe. Although several species of yeasts have been grown for food use, only strains of *S. cerevisiae* and *Candida utilis* are cultivated in the United States. *C. utilis* is better able to utilize sugars from waste sulphite liquor from wood pulp manufacture. Dried yeasts are used as nutritional supplements in a number of foods in the United States.

*Medicinal yeast* was first recognized by the United States Pharmacopeia in 1944 as the non-fermentable "dry cells of any suitable strain of *S. cerevisiae*," with a second species, strains of *C. utilis*, added in 1956. Yeast is a rich source of the B-complex vitamins, and its protein is well balanced in amino acids. Yeast or a yeast deriva-

tive, ergosterol, acquires vitamin D<sub>2</sub> activity after irradiation with ultraviolet light. Other yeast derivatives are used in the medium in which antibiotic-producing organisms are grown and as a starting point in the synthesis of steroid hormones.

The chemical composition of yeasts varies with the species and growing medium. Dried yeasts have been found to assay: protein, 45 to 55 percent; fat, 0.5 to 2.5 percent; ash (minerals), 5 to 7 percent; carbohydrates, 35 to 45 percent; and moisture, 4 to 6 percent.

See also BREAD AND BAKING; BREWING AND MALTING—*Brewing Operations and Equipment* (Fermentation); DISTILLATION—*Products of Distillation* (Alcohol); FERMENTATION; FUNGI—*Class Ascomycetes* (Yeasts); VITAMINS; WHISKEY, WINE—2. *Production* (Fermentation).

CARROLL F. NEFF  
Technical Consultant

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**YEATS**, yáts, **Jack Butler**, Irish painter: b. London, England, Aug. 23, 1871; d. Dublin, Ireland, March 28, 1957. He was the son of the artist and wit John Butler Yeats (1839–1922) and the brother of William Butler Yeats (q.v.). Most of his childhood and youth he spent in Sligo and the west of Ireland, where the living oral traditions and vivid folk imagination had a lasting influence on him. He was privately educated in Sligo. Later he moved to England but returned each summer to Ireland.

Yeats' early work, water colors and drawings of Irish genre, was part of a minor renaissance in Irish painting that accompanied the greater flowering in literature. He particularly enjoyed representing individuals whose lives had some element of risk—gypsies, clowns, pugilists—and was inspired by some of the romantic figures of his country's political past—Wolfe Tone, Robert Emmet, and Charles Stewart Parnell. He reached maturity in the early 1920's, when the color and atmosphere in his paintings took on a new license that transformed his subjects—many of them now taken from city life. Until around 1937 he pro-

duced paintings that fuse high poetry and acute observation, reclaiming mundane subject matter in romantic terms. Much of his best work was done at this time.

In 1937, somewhat disillusioned by the new Ireland and moved by the threat of war, Yeats started a series of allegorical paintings, beginning with *Helen* (Tel Aviv Museum) and ending 14 years later with *Basin in Which Pilate Washed His Hands* (1951, private collection). In this series he celebrated public and private tragedies with a resonant dignity, touched by wildness. A master of suggestion, he occluded his symbols so that they remain highly personal but fruitful in an odd, antic way. After 1951 his work, while uneven, reached new heights of lyric inspiration. His color was more agitated and broken; painting entirely with the knife, he leaned more and more on suggestion than on statement. He returned to his early themes of the clown, gypsy, and beggar. Some of this late painting is remarkable for its piercing and pure intensity.

Yeats had little concern for public success and refused to nourish his reputation, but he is the greatest of modern Irish artists and a highly individual figure. His work is intensely lyrical and romantic, with expressionist overtones, and it is unusual in modern art for its insistence on a joyous and exuberant vitality. Predominantly a colorist, he admired Jean Antoine Watteau, Honoré Daumier, and Venetian painting but firmly denied any influence on his own art. He also wrote a number of vivid novels and plays that show his interest in the individual and wayward characteristics that to him illuminated human nature.

BRIAN O'DOHERTY,  
*Art Critic, New York "Times."*

**YEATS, William Butler**, Irish poet, dramatist, and essayist: b. Dublin, Ireland, June 13, 1865; d. Cap-Martin, France, Jan. 28, 1939. His grandfather and great-grandfather were rectors in the Church of Ireland (Protestant), but his father, John Butler Yeats, broke away by becoming a skeptic in religion and a portrait painter by profession. Yeats spent much of his childhood in Sligo, a port town in the west of Ireland where his mother's relatives lived. The landscape of this region was always his favorite, and it served him as the setting for many of his poems.

In 1874 the family moved to London, where they longed for Ireland, and in 1880 they returned to Dublin. Yeats was at this time heavily under his father's influence, which was rationalistic as well as artistic; but partly in filial revolt he began, near the end of his attendance at high school, to show a fascinated interest in the study of occult phenomena. He attended art schools in Dublin from 1884 until 1886, when he committed himself to a literary career.

**Irish Literary Revival.**—Yeats found everywhere, in Irish folklore, in poetry, and in mystical writings, support for his conviction that literature should concern itself with the dreaming as well as the conscious mind and should rebel against the encroachments of science upon imagination. He gained more adherents to another aspect of his thought, a belief that all art should be national. In the early 1890's he founded Irish literary societies in both Dublin and London and almost at once became the leader of a school. He urged Irish writers to use Irish landscape, to take themes from Irish legends and sagas, to saturate their work in whatever was local and therefore inti-

mate. On these principles he wrote his first book, *The Wanderings of Oisín and Other Poems* (1889), and his first important play, *The Countess Kathleen* (1892). A few years later he and Lady Gregory joined talents to start a new dramatic movement in Ireland, resulting in the founding of the Abbey Theatre in 1904. Yeats was the major influence upon this world-famous theater for the rest of his life, although some of its playwrights, notably John Millington Synge and Sean O'Casey, scored greater popular successes with their plays than he did.

**Poetic Development.**—Yeats was one of the first poets in English to make deliberate use of symbolism, so that all his work is closely bound together by an elaborate context of implicit meanings. His poetic development may be divided into two stages. The first, which lasts until about 1900, is characterized by otherworldly and ecstatic themes and slow-paced rhythms. It is associated with his unrequited love for Maud Gonne (1866–1953), a beautiful Irish patriot; his passion for her is idealized to become part of a search for perfection. In the second stage, Yeats takes account of elements that he had previously excluded; his writing is more physical, combative, and salty. He is more aware of imperfection and often indignant with it. Instead of *The Shadowy Waters* (1900), he writes *Responsibilities* (1914). His diction comes closer in this second stage to ordinary speech.



William Butler  
Yeats

Radio Times Hulton  
Picture Library

The strength and solidity of Yeats' verse increased as he grew older. These qualities were buttressed by his late marriage, in 1917, to Georgie Hyde-Lees, an Englishwoman, with whom he lived chiefly in Dublin and at their old Norman tower, Thoor Ballylee, in the west of Ireland. They had a son, Michael, and a daughter, Anne. When the Irish Free State was formed, Yeats was appointed one of its first senators (1923–1928), and in 1923 he received recognition of a more international kind by the award of the Nobel Prize for literature.

In the poetry he wrote after his marriage Yeats shared more fully than before the aspirations, regrets, and grievances of the contemporary world. Although his early books continue to have their admirers, he is best known by books written later, especially by *The Tower* (1928), *The Winding Stair* (1933), and *Last Poems* (1940). Here he expressed most memorably his powerful feelings about the possible ruin of civilization, about old age and youth, about moments of sudden illumination and joy, and about the unending debate that goes on within the mind as opposing

passions struggle to master each other.

**Basic Themes.**—Yeats' work deals intensely with three basic urges. The first is to be in the midst of things, to live with the delight, ebullience, and versatility of a Renaissance man. Running counter to this is a second urge, to rise above the melee, to contemplate rather than merely to act, to sift wasteful life for its economical, artistic essence. There is a third urge, which Yeats repudiates, although he gives it expression, and this is to seek goodness alone, to become as bodiless as possible both on earth and in heaven. This is the way of the saints, and when faced with it Yeats prefers to stand with "Homer and his unchristened heart." Much of the effect of his verse comes from its moving affirmation—over frankly admitted obstacles and doubts—of intense, unified, imaginative life.

See also **IRISH LITERARY REVIVAL**.

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**YECLA**, yä'klä, city, Spain, in the northeast corner of the Province of Murcia, on the Juá River, a tributary of the Segura. It is connected with Murcia, the capital, by rail and highway. The surrounding countryside is mountainous and has numerous streams. There is some manufacture of soap and sandals, but agriculture is the main occupation, producing grains, wines, and olive oil. There are two mineral springs, Fuente del Alamo and Fuente de la Negra. Yecla is an old city, and the countryside contains the ruins of several fortresses. In 1813 the city was the scene of a fierce battle in which the French defeated the Spanish defenders and won control of the region. The city figures prominently in the writings of the modern Spanish essayist and novelist Azorín (José Martínez Ruiz). Pop. (1950) 24,046.

GREGORY RABASSA.

**YEDO.** See TOKYO.

**YEHUDAH.** See JUDAH.

**YELIZAVETPOL.** See KIROVABAD.

**YELLOW**, yē'l'ō, the prismatic color that lies between red and green in the color spectrum. The electromagnetic radiation that gives the sensation of yellow has a wavelength centered at about 5750 angstroms, although this value varies somewhat from one person to another. The human eye is extremely sensitive to yellow (the peak of the color-sensitivity curve falls between yellow and green), and it is probably for this reason that yellow signs and markers are widely used to indicate caution or danger.

Yellow filters, which absorb blue and violet light and transmit red and green light, are the most useful photographic filters. Yellow dyes and pigments have numerous applications; for information on these see COLOGNE YELLOW; COLOR; DYES AND DYEING; NAPLES YELLOW; OCHER; PAINT. See also COLORS, SYMBOLIC; LIGHT.

KENNETH W. PERKINS.

**YELLOW BASS.** See BASS.

**YELLOW BOOK**, an illustrated quarterly published in London by John Lane from 1894 to 1897. The American novelist Henry Harland was literary editor, but the decadent tone of the periodical was set by the brilliant young illustrator Aubrey Beardsley, its art editor during the first two years. Among *fin de siècle* writers and aesthetes who contributed to the *Yellow Book* were Max Beerbohm, Frederick William Rolfe, Arthur Symonds, John Davidson, Ernest Dowson, and Lionel Johnson. The poets William Watson and William Butler Yeats and the novelists Henry James and George Moore also were contributors. Apparently to conciliate his critics Lane sought to add more conservative writers and literary historians such as George Saintsbury, Edmund Gosse, Richard Garnett, Austin Dobson, and Henry Duff Traill. The original brilliance of the publication thus dwindled, and after the 13th issue the quarterly folded.

WILLIAM BRACY.

**YELLOW-EYED GRASS**, the common name given to many species of plants in the genus *Xyris*, of the family Xyridaceae. It is not a grass, but the narrow leaves that sheath the base of the leafless scape (stalk) give it a grasslike appearance. *Xyris* (from *xyron*, razor) is a Greek name for a plant with 2-edged leaves. The flowers (usually yellow) are borne in a head at the end of the scape, which arises from a bulbous or non-bulbous rootstock along with the basal leaves. The individual flowers have 3 sepals, 3 petals, 3 fertile stamens, and 3 staminodes, with a 3-carpellate, 1-locule superior ovary that becomes a 3-valved loculicidal capsule at maturity. The genus is most common in subtropical or tropical America and occurs in Africa, Australia, and India; about 20 species grow in North America from Newfoundland to Florida and westward to Texas, and along the St. Lawrence River and Great Lakes. The North American species are often found in bogs or swamps or along the edges of ponds; a few are true aquatics and grow in swift-flowing streams. Two of the most common North American species are *X. flexuosa* and *X. torta*, both of which have bulbous rootstocks, 2-ranked linear twisted leaves, and 2-edged twisted scapes. The yellow flowers of *X. flexuosa* are more conspicuous because of the long-fringed lateral sepals projecting beyond the bracts. *X. fimbriata*, a plant with strap-shaped leathery leaves, also has sepals that are conspicuously fringed and projected. Economically the family is of little importance. Two species are used in aquatic gardening and aquariums, and the foliage and roots of three species have been used as a remedy for leprosy and some skin irritations in Brazil, the Guianas, and India.

DAVID E. FAIRBROTHERS,  
Associate Professor of Botany, Rutgers—The  
State University, New Brunswick, N.J.

A doctor takes a blood specimen from a yellow-fever sufferer in the Amazon River region's vast tropical rain forest in Brazil. Such specimens are used in studying viruses that cause the disease after being transmitted to humans by mosquito bites.

World Health Organization  
Photo by Maxine Rude



**YELLOW FEVER** (also known as **YELLOW JACK**), an acute infection of man, caused by a virus and transmitted to man by the bite of an infected mosquito. The name follows from the deep jaundice observed in the seriously ill human. The Spanish name *vomito negro* (black vomit) derives from the hematemesis often seen in seriously ill cases.

**History.—Pre-20th Century.**—The pre-Columbian history of yellow fever in the Old and New Worlds is unknown. It is conjectured that the disease was native to Africa and was introduced into the New World. The story of yellow fever in the New World is one of repeated and devastating epidemics among the populations of the seaports of South America, Central America, the West Indies, and the United States through the 17th, 18th, and 19th centuries. During the 18th century, severe epidemics also occurred in Spain and southern Europe. Epidemics in the tropical ports were likely to occur at any season of the year, while epidemics in more northerly ports of the United States, such as New York, Baltimore, and Philadelphia, and in the more southerly ports of Argentina and Chile occurred during the summer season and terminated with the advent of cooler weather. Since it was recognized that cases occurred among passengers and crews of vessels coming from tropical ports, early quarantine services inspected incoming vessels for evidence of yellow fever aboard; when suspicious signs were found, the "yellow jack" (quarantine flag) was raised, forbidding the docking of the vessel or discharge of passengers until danger was deemed to be past. Such measures were in effect decades before the mechanism of the transmission of the disease by mosquitoes was known. In retrospect, the puzzling persistence of the disease on slow sailing vessels is readily understood: the freshwater containers on such ships often bred the vector mosquito. One sick human being aboard a vessel could infect the mosquitoes, which in turn could infect passengers and crew. Ports visited, where infected passengers or infected mosquitoes or both could be discharged, were endangered.

It was also early recognized that in the tropics, even in the absence of recognized cases of yellow fever, the influx of a considerable number of individuals fresh from Europe often resulted in devastating outbreaks of the disease. From this arose the erroneous belief that natives

of a region were not liable to infection but newcomers were.

The early history of yellow fever in Africa is not known. However, attempts during the 19th century to establish trading posts and military garrisons at various points along the west coast of Africa were notably unsuccessful, largely because of yellow fever, malaria, and dysentery, and the region in general became known as "the white man's grave."

**Discovery of Transmission Mechanism.**—There were many theories about the cause and method of transmission of yellow fever. Carlos Juan Finlay (q.v.) of Havana, Cuba, in the late 19th century maintained that a certain mosquito, *Aedes aegypti*, then known as *Stegomyia fasciata* and ubiquitous in many tropical seaports, was the carrier of the disease. Walter Reed (q.v.) and his associates James Carroll, Aristides Agramonte, and Jesse Lazear, put Finlay's theories to the test and succeeded in 1900 in transmitting yellow fever from one human volunteer to another through the bite of *A. aegypti*. This work was carried out while Reed was a United States Army surgeon stationed in Havana. The group also showed that yellow fever was not transmitted by means of contact, excreta, or soiled clothing and therefore was not contagious.

William Crawford Gorgas (q.v.), another United States Army surgeon, immediately set to work to eliminate *A. aegypti* from Havana. Although his efforts fell far short of eradicating the species, yellow fever speedily disappeared. Oswaldo Cruz similarly cleaned up Rio de Janeiro, Brazil, with parallel results. It is difficult today to realize the excitement with which this conquest of the disease was hailed throughout the West Indies and Central and South America as city after city instituted effective control programs. For over 30 years the opinion prevailed that, if mosquito control programs could be carried out with sufficient rigor, yellow fever would disappear. Some workers had doubts, however, as they noted that cases of yellow fever occasionally occurred in villages where *A. aegypti* was absent and among workers in the forest where, at least in the New World, this mosquito is not found.

**Persistence.**—In 1933 the occurrence of jungle yellow fever in Brazil and Colombia was first reported. Later workers extended and amplified the picture, showing that there is a cycle of transmission of the disease among New World monkeys by several species of the mosquito genus

**Haemagogus.** The larvae of these mosquitoes develop in the water that accumulates in tree holes, and the adults spend their lives in the upper canopy levels of the tropical forest. Hunters and woodsmen, working in a region where the disease is current among monkeys, are likely to be bitten by *Haemagogus*, acquire an infection, and sicken in the forest or possibly in a town. In the latter instance, there is grave danger of infecting *A. aegypti* in the town and thus starting an epidemic.



Shaded area shows part of South America where yellow fever is endemic. Visitors are protected by vaccination.

In the forests of equatorial Africa another mosquito, *A. africanus*, has been shown to be a carrier of the disease, maintaining the infection in the forest primates. *A. simpsoni*, which is found more frequently near human settlements than is *A. africanus*, may pick up infection from marauding monkeys from the forest and thus provide a convenient bridge to humans. *A. aegypti* is widespread both in cities and villages and in the forest.

Epidemics of yellow fever are not a thing of the past. In 1933-1938 a massive sweep of the virus was observed in Brazil, originating presumably in the Amazon regions, progressing south-eastward through the country, and reaching the Atlantic coast at Rio de Janeiro. In 1940 a severe epidemic was recorded among the inhabitants of the Nuba Mountains region of the Sudan. In the mid-1950's a massive sweep of infection occurred, progressing northward from Panama through Central America to the southern frontiers of Mexico. In 1954, after an absence of 40 years, there was a small epidemic on the island of Trinidad in the West Indies, and a later small episode occurred there in 1959. In 1961 a massive outbreak was recorded for southwestern Ethiopia. Sporadic cases of the disease are reported frequently from certain countries of the African and New World

tropics; such occurrences are recorded in the *Weekly Epidemiological Record* distributed by the World Health Organization.

**Virus.**—Walter Reed showed that the agent of the disease was able to pass a fine filter. Hideyo Noguchi (q.v.), apparently confusing cases of Weil's disease (leptospirosis) with yellow fever, described a causative organism, *Leptospira icteroides*. Later work, however, has established conclusively that the causative agent is a filterable virus, a virus particle having a diameter of 20 millimicrons (0.0000008 inch). By immunological affinities, it is placed in Group B of the arthropod-transmitted viruses, a group which includes such agents as the viruses of dengue, St. Louis encephalitis, and Japanese B encephalitis.

**Symptomatology.**—A frank attack of yellow fever is characterized by acute onset, with headache, dizziness, rapid rise of fever, backache, nausea, and vomiting. This stage lasts two or three days and may be followed by a brief remission lasting at most a day or two. The more severe cases proceed into stages of deepening intoxication, with high fever, slow pulse, jaundice, albuminuria, and collapse, and death may occur on the sixth or seventh day of illness. However, this classic form of the disease is known to occur in only a small proportion of those infected. Many cases are ill for only a few days, without progression into more serious stages, and many of those afflicted suffer a very mild infection, undiagnosable clinically as yellow fever even during an epidemic when the index of suspicion is high. Recovered cases have no aftereffects but retain a lifelong immunity against later infection. The death rate is difficult to establish; among recognizably ill patients, it may run as high as 50 percent, but in the 1954 outbreak in Trinidad it did not exceed 1 in 1,000 of those infected. No specific treatment exists. Supportive therapeutic measures are indicated, and absolute rest is advisable during the acute phase.

**Diagnosis.**—During an outbreak, a severe case of yellow fever is not likely to go unrecognized.

Endemic area of Africa (shading). Mosquito control helps protect cities but is impracticable in forest areas.





However, the sporadically occurring severe case or the severe case occurring early in a developing outbreak may well be confused with other diseases. Milder cases may easily be mistaken for other mild fevers. Consequently, the laboratory offers the only certain means of diagnosis. Positive diagnosis is effected by the isolation of the virus from the blood stream during the early stage of the disease (virus has been isolated as late as 11 days after onset) or from the liver of fatal cases. The serum or liver suspension is inoculated subcutaneously into monkeys or intracerebrally into white mice, which are then observed for signs of illness. Microscopic examination of liver tissue of fatal cases may reveal characteristic pathological changes indicative of the disease.

Positive diagnosis can also be made by the protection or neutralization test, carried out in white mice or in an appropriate tissue culture. Serums from a blood sample taken early in the disease and from another sample taken 10 days or more later are compared by mixing each with a known amount of yellow fever virus and inoculating into the mice or culture. If there is a marked difference in the degree of protection (neutralization of virus by immune substance or antibody) afforded by the second specimen, a diagnosis of yellow fever is warranted. Special immunological reactions may also be useful. Complement-fixing antibodies and antibodies inhibiting the agglutination of chicken or goose erythrocytes by yellow fever virus develop during the course of the disease and can be measured by appropriate tests. Cross-reaction with other related Group B viruses complicates the interpretation of the complement-fixation and hemagglutination-inhibition tests, and considerable experience is needed in their interpretation.

**Prevention and Control.**—The vector mosquito, *A. aegypti*, has been eradicated from many countries of the New World, and the World Health Organization is continuing with a program of eradication for the rest of the Western Hemisphere. The problem of jungle yellow fever in the New World tropics still remains. In Africa, *A. aegypti* control affords some measure of protection in towns and cities, but mosquito control measures are not practicable for the forested areas.

Vaccination is the recommended procedure for populations likely to be in contact with yellow fever. Over 95 percent of those vaccinated develop demonstrable immunity, which appears in 10 days to 2 weeks and persists for longer than 6 years. The 17D strain of vaccine developed by Max Theiler through repeated passage of a virulent strain of virus in tissue culture is routinely employed. In the course of passage, the virulence of the original strain is lost. The derived (17D) strain, inoculated subcutaneously into humans, produces a very mild infection with few or no symptoms and imparts a long-lasting immunity against the virulent virus. The vaccine is prepared in embryonated chicken eggs. A second type of vaccine, known as the French neurotropic strain, modified in virulence by brain-to-brain passage in white mice, is extensively used by the French in Africa and is administered by scarification.

International control has two responsibilities. Individuals entering regions where yellow fever is endemic (see accompanying maps) can easily be protected by requiring vaccination; however, many countries where yellow fever is known or suspected to be endemic do not require vaccination. A second grave responsibility is the protec-

tion of areas where yellow fever does not occur but *A. aegypti* flourishes, as in Southeast Asia and the East Indies, including India, and the countries of the Mediterranean area. Introduction of the virus by means of a human carrier or an infected mosquito constitutes a continuing threat in these areas. Regulations requiring evidence of yellow fever vaccination of individuals entering such areas from known endemic areas and for spraying aircraft with insecticides before landing are now generally, although not uniformly, in force.

*International Sanitary Regulations* provides current information on endemic areas, requirements for vaccination and revaccination, and control of international travel.

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**YELLOW-HAMMER.** See YELLOWHAMMER.

**YELLOW-HEADED BLACKBIRD.** See BLACKBIRD.

**YELLOW JACK,** a yellow flag displayed by ships that have cases of communicable disease aboard or have been quarantined. It is also a common name for yellow fever (q.v.).

**YELLOW JACKETS.** See WASPS—Social Wasps.

**YELLOW JOURNALISM,** a term synonymous with "sensationalism," used in the sense that a newspaper or periodical deliberately undertakes to capture reader attention and interest by a contrived emotional appeal basically unwarranted by fact or subject matter. The methods employed are the selection or creation of subject material lending itself to this purpose; the use of appropriate styles of writing, typographical displays, and illustrations; and general promotional publicity.

Although there had previously been sensationalism of some sort or degree in more than one country and over a long period of time, the use of the term "yellow journalism" derives from practices by two New York City newspapers during the latter half of the 1890's. The *New York World* had presented what purported to be humorous drawings since 1889, the beginning of comic strip usage. In 1893 the *World* became a pioneer among newspapers in the use of color. In February 1896 it used its color press to add a yellow tint to a shapeless sacklike garment worn by a gap-toothed young ragamuffin, the central figure in a series of drawings by Richard F. Outcault, portraying fanciful incidents in a city tenement district. This was a novelty, and "the yellow kid of Hogan's Alley," as the youngster came to be known popularly, helped to bring new circulation to the paper.

In 1895 William Randolph Hearst, after developing the San Francisco *Examiner* as his first newspaper, had purchased the *New York Journal* and entered into direct competition with the *World* for morning newspaper circulation leadership. Observing the popularity of Outcault's drawings, Hearst offered him financial inducements to produce the "yellow kid" for the

*Journal's* Sunday color supplement. This he began to do in October 1896. The *World* countered by engaging George B. Luks to continue the "yellow kid" in that paper. The rival "yellow kids" were widely publicized throughout the New York area on posters and on the sides of circulation wagons.

At the same time, the *Journal* and the *World* were competing for readers by other means, such as seeking news and even creating news that could be written and presented to arouse the greatest emotional response among prospective readers, including buyers at the newsstands and in the streets. This practice involved an emphasis on crime, sex, and violence. It exploited especially the then current revolt of the Cubans against Spanish rule, which led directly to the Spanish-American War in 1898. It involved a resort to typographical extravagances beyond any previously known, including the use of large headlines, some occupying half of the first page or more, frequently printed in lurid colors, and often conveying distorted impressions. This was supported by no less distorted writing and by illustrations specially drawn to create the desired impact. The result was to win for both newspapers the largest circulations so far known anywhere on earth, sometimes exceeding a million copies a day.

The excesses to which the papers went, however, offended and outraged many thoughtful citizens and dismayed competing papers in New York. Ervin Wardman, editor of the *New York Press*, associated the two manifestations—sensationalism and rival promotion of the "yellow kids"—in a blanket reference to the "yellow press" of New York, from which the use of the term "yellow journalism" in the broader sense evolved.

ROBERT W. DESMOND,

Professor of Journalism, University of California at Berkeley.

**YELLOW PERCH.** See PERCH.

**YELLOW PUCCOON.** See YELLOWROOT.

**YELLOW RATTLE**, the common name of several species of plants belonging to the genus *Rhinanthus* (called *Alectorolophus* by some botanists), of the figwort family Scrophulariaceae. The generic name, from Greek *rhis* (snout) and *anthos* (flower), refers to the beaked upper corolla lip of a species no longer included by botanists in the genus *Rhinanthus*. The sessile flowers (usually yellow) are borne in the axils of the uppermost bracts of the stems, which bear opposite leaves. The individual flowers have four sepals, which become inflated in fruit; five two-lipped petals with a hooded upper lip and a three-lobed lower one; four stamens; and a loculicidal orbicular capsule containing round-winged seeds, which rattle in the fruit when it is shaken. The plants are root parasites, attaching themselves to various species of plants, and sometimes become pests in the fields of Europe.

The genus *Rhinanthus* is most common in the Arctic and cold temperate zones of the Northern Hemisphere, occurring in Asia, Europe, and North America. The most common species in North America is *R. crista-galli*, which grows from Labrador to Alaska and British Columbia and south to southern New England and northern New York State. The name "rattlebox," sometimes confused with yellow rattle, should be

applied only to species of the genus *Crotalaria*.  
DAVID E. FAIRBROTHERS.

**YELLOW RIVER.** See HWANG HO.

**YELLOW-ROOT.** See YELLOWROOT.

**YELLOW SEA** (Chin. HWANG HAI or HUANG HAI), one of the extreme western outliers of the Pacific Ocean bordering the coastlines of Shantung and Kiangsu provinces, China, and situated north of the East China Sea between the China mainland and the Korean Peninsula. Approximately 400 miles long and 400 miles wide, the Yellow Sea is connected with the gulfs of Chihli (Po Hai) and Liaotung to the north by the Strait of Chihli, which separates the Liaotung and Shantung peninsulas.

Among the major rivers flowing into the Yellow Sea are the Yellow, Hwai, Liao, Pai, and Yalu rivers of China, and the Korean Han and Taedong rivers. Major ports along the Yellow Sea and Gulf of Chihli include Lienyün, Tsingtao, Yantai (Chefoo), Tangku (Sinkang), Chingwangtao, Hulutao, Port Arthur (Lüshun), Talien (Dairen), and Sinkin (Hsinchin, Chengtsetuan) in China; Inchon in South Korea; and Chinnampo in North Korea.

BARUCH BOXER

**YELLOW-WOOD.** See YELLOWWOOD.

**YELLOWHAMMER**, yél'ô-häm-ər (also called **YELLOW BUNTING**), a familiar songbird (*Emberiza citrinella*) of Europe. The yellowhammer is about 6½ inches long and is a typical bunting with a streaked plumage. The ground color is yellow below and brownish above, and the male has a distinctive yellow head. The yellowhammer inhabits bushes in grasslands or open areas and has a tinkly song. The breeding range extends eastward from Europe to Iran and central Siberia; the bird tends to be resident (nonmigratory) throughout its range.

CHARLES VAURIE.

**YELLOWKNIFE**, yél'ô-nif, a town in the Northwest Territories, Canada, in Fort Smith Region, 600 miles (970 km) north of Edmonton and 280 miles (450 km) south of the Arctic Circle, on the west shore of Yellowknife Bay, a broadening of the Yellowknife River where it flows into Great Slave Lake. The name is derived from the Yellowknife Indians, an Athapaskan tribe living to the north of Great Slave Lake and given the name Yellowknife because they used tools of native copper. The settlement began with the discovery of rich gold ore deposits near Yellowknife Bay in 1934 and 1935. Another gold strike in 1944 led to a second period of expansion, and as the original townsite became too cramped, a new town was built on a different site. It is now the largest center in the Northwest Territories. Two producing gold mines support most of Yellowknife's population, but it is also the center for another gold mine 60 miles to the north and for the development of mineral properties throughout the surrounding region. There is daily air service to Edmonton, and the Great Slave Highway, opened in 1961, makes it possible to drive to Yellowknife from southern Canada. It became a municipal district in 1952 and was incorporated as a town in 1963. Population: 9,483.

GRAHAM W. ROWLEY.

**YELLOWLEGS**, yel'ô-lëgz, the common name of two large North American shorebirds of the genus *Totanus*. The greater yellowlegs (*T. melanoleucus*) is about 14 inches long and breeds in the muskeg country of the northern forests from southern Alaska, southern Mackenzie District, and the Ungava Peninsula, Canada, south to central British Columbia, central Alberta, James Bay, south-eastern Quebec, and Newfoundland. The lesser yellowlegs (*T. flavipes*) is about 4 inches smaller and has a somewhat similar breeding range which, however, extends a little farther north to the forested tundra. It also prefers drier sites as a rule and is especially attracted to areas that have been recently burned over. The two birds are identical in appearance, except for the marked difference in size. They are ashy or brownish gray above, mottled with white, and white below speckled with gray, and have bright yellow legs. Their loud, clear calls are rather similar, but those of the greater yellowlegs are uttered in groups of 3 or 4 notes, as against 1 or 2 for the lesser yellowlegs. The birds nest on the ground, laying 4 eggs that are heavily marked with brown, in a shallow scrape or natural depression.



Allan D. Cruikshank, from National Audubon Society

Greater Yellowlegs (*Totanus melanoleucus*)

The period of incubation lasts for about 3 weeks. Their food consists of insects or small aquatic animals. Both species are highly migratory and winter from the southern United States to the tip of South America. On migration and on their winter grounds they frequent the grassy margins of pools, lakes, and the mud flats along the sea.

CHARLES VAURIE  
American Museum of Natural History

**YELLOWROOT**, yel'ô-rôot, the common name of three berberine-containing plants in the buttercup family (Ranunculaceae). *Xanthorhiza simplicissima*, shrub yellowroot, grows in the southeastern United States. The interior of its roots and stems is bright yellow and astringent and has been used in tonic bitters. It is about two feet tall, and its leaves give it a fernlike appearance. *Coptis groenlandica*, often called goldthread, is a tiny, slender shrub recognized by its shiny evergreen three-parted leaves. It occurs in cool woods, ranging northward from the mountains of North Carolina. The brilliant yellow, bitter stems and roots have been used in local applications for ulcers of the mouth. *Hydrastis canadensis*, sometimes called

orangerooot, goldenseal, or yellow puccoon, is an herb with a single basal and two stem leaves with reniform, palmately lobed blades. It occurs in deciduous forests from Nebraska and Arkansas eastward. Highly valued for use in drugs for catarrh and inflammation of the gastrointestinal tract and other mucous membranes, it has been almost exterminated by herb gatherers. The Indians prized the rootstock as a source of yellow dye.

A. J. SHARP  
University of Tennessee

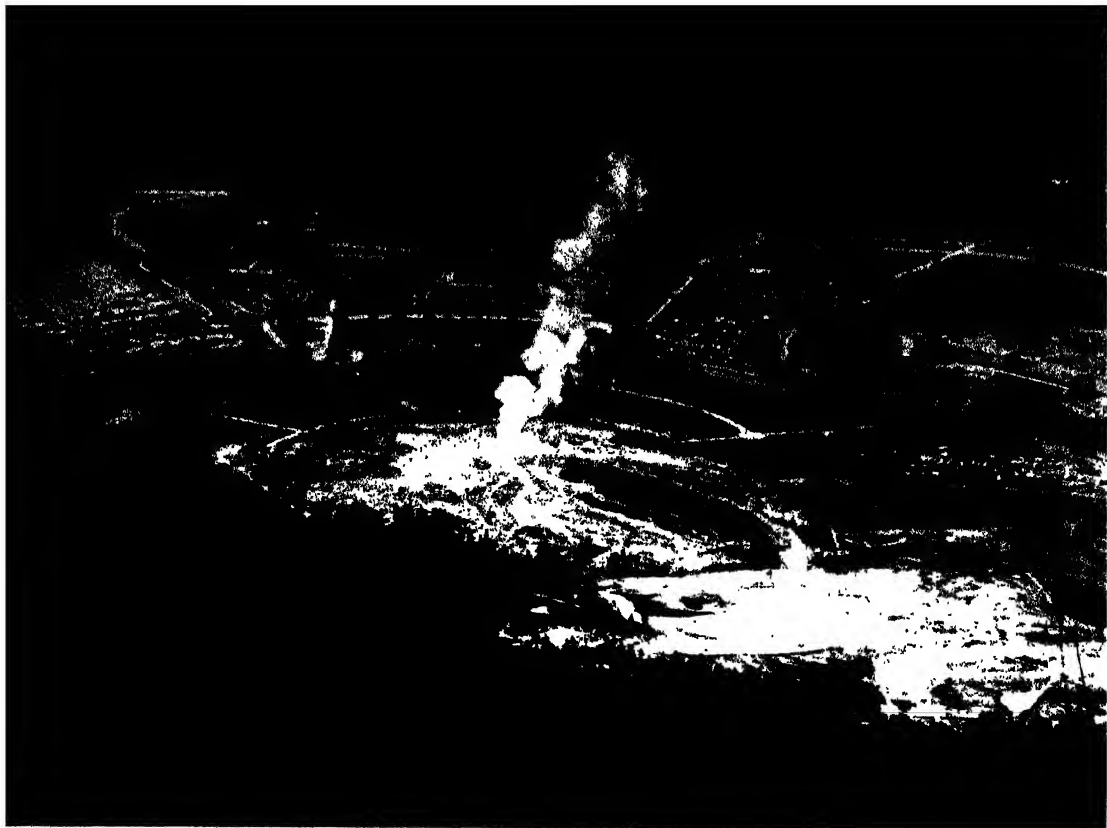
**YELLOW VIRUSES**, yel'ôz vî-ras-az, plant-pathogenic viruses that cause diseases of the plant subclasses Dicotyledoneae and Monocotyledoneae. The diseases, called yellows, are characterized by chlorosis without spotting, by stunting, and by adventitious shoots with long or short internodes. Examples are aster yellows, peach yellows, and corn stunt. So far as is known, all insect vectors of yellows viruses belong to leafhoppers of the family Cicadellidae. These carriers show a high degree of specificity, so that transmission of each virus is limited to a small number of insect species, often closely related. The specificity may be so extreme that different strains of a single virus are transmitted by different species of leafhoppers. In some instances, where several virus strains are transmitted by the same vector species, a process of interference occurs in the insect so that all are excluded except the virus strain first acquired. It has been difficult or impossible to transmit most yellows viruses mechanically to plants, except through grafting. Grafting through a "bridge," by means of plant-parasitic species of *Cuscuta* (dodder), permits the transmission of infection from plant to plant for the purpose of laboratory study. *Vinca rosea* (periwinkle), susceptible to most yellows viruses, has become a preferred experimental host for both the study and storage of yellows viruses.

All yellows viruses of this group are retained in the insect vectors, and all have long incubation periods in both plants and leafhoppers. Several yellows viruses multiply not only in diseased plants but also inside their vectors. For this reason the yellows viruses can be considered as both plant and insect viruses. In spite of their worldwide distribution, very few yellows viruses have been characterized morphologically. Control of the diseases in plants is difficult because field applications of insecticides seldom destroy all vectors and the few remaining survivors continue to infect plants. Complete control can be achieved by screening to prevent the access of infected leafhoppers to the plants so protected.

KARL MARAMOROSCH  
Boyce Thompson Institute for Plant Research

**YELLOWSTONE LAKE**, yel'ô-stôn, lake, Wyoming, in Yellowstone National Park, at an elevation of 7,731 feet, with a maximum depth of 300 feet and an area of 139 square miles. Its remarkable size is due to the gently sloping surface of the lava plateau, further smoothed by glaciation. The lake measures 21 miles in length from the outlet at the north to the south end of the southeast arm and is fed and drained by the Yellowstone River (q.v.). It is extremely popular as a fishing lake. West Thumb Geyser Basin lies at the end of the western arm, and the thermal activity actually extends out into the water.

NICHOLAS HELBURN  
Western Michigan University



GEORG GERSTER, FROM PHOTO RESEARCHER

Old Faithful geyser in Yellowstone National Park is noted for the regularity and height of its eruptions.

**YELLOWSTONE NATIONAL PARK**, a national park in Wyoming, Montana, and Idaho, with most of its area in Wyoming. It is the largest and oldest unit in the national park system of the United States. A plateau area within the Rocky Mountains, shaped approximately in a square with 60 miles to a side, the park has an area of about 3,472 square miles. Geysers, which occur in very few other places in the world, occur here in profusion, along with hot springs, steam vents, and associated phenomena. The park is administered by the National Park Service, and park headquarters are located at Mammoth, Wyo.

**Natural Scene.** During the last 50 million years the park plateau has been built up of hundreds, possibly thousands, of feet of lava and breccia. This plateau is rimmed by four mountain ranges. The Gallatin Range extends through much of the western side of the park; the Beartooth Range dominates the northern margin. The crest of the Absaroka Range constitutes the eastern boundary and provides a rugged skyline when seen from the lower general surface of the plateau. The southern margin is formed by the highlands of the Jackson Hole country including the Teton Range, the major feature of an adjacent but independent national park (Grand Teton). The general elevation of the Yellowstone region is from 7,000 to 8,000 feet; among the highest mountains are Electric Peak (10,992 feet) and Eagle Park (11,358 feet).

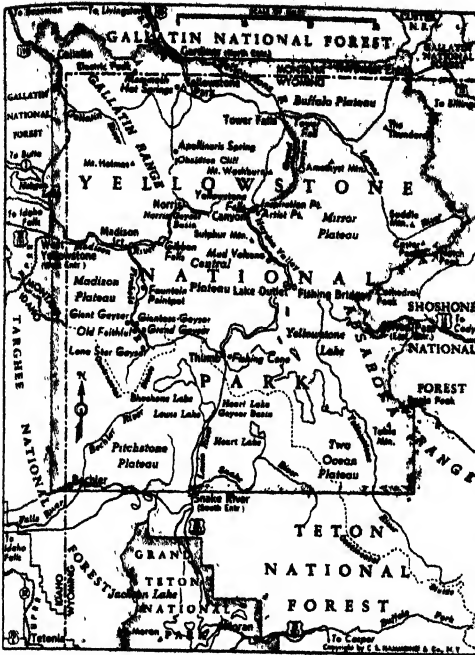
Most of the park is drained by the Yellowstone River, a major tributary of the Missouri-Mississippi river system. Portions of the western side drain into the Madison and Gallatin rivers, which are also Missouri tributaries. Part of the south side of the park is on the Pacific

slope of the Continental Divide draining through the Snake River into the Columbia River.

The most spectacular scenery of the region is carved into the plateau surface by the Yellowstone River. Between the Upper Falls, Lower Falls, and Tower Junction, the Yellowstone has cut one of the great canyons of North America, over 1,000 feet deep and 24 miles long. Early hydrothermal activity weakened the rock and colored it shades of yellow, orange, and red, as well as buff and gray. The canyon is steep-walled with no flat floor; there is only room for the turbulent, bright green river itself at the bottom. Pinnacles and spires stand up from the steep sides. At the southern end of the river, the Upper Falls have a drop of 109 feet, and the Lower Falls a drop of 308 feet.

**Geysers and Hot Springs.** For most visitors the features of central interest in the park are the geysers and hot springs. These are related to the geologically recent volcanic action in the region, as a result of which water from the surface encounters unusually hot rock within a few hundred feet of the surface. Heated, and in some cases turned into steam, this water returns to the surface, causing the unusual thermal phenomena. During the water's movement, minerals are picked up, and some are deposited near and on the surface. This material is responsible both for the unusual surface forms and also for the contorted subsurface caverns which allow the geysers to develop.

In one area, Mammoth Hot Springs, the mineral in solution is calcium carbonate. The hot water, upon cooling at the surface, precipitates some of the mineral as travertine, making broad terraces. In other regions the hot water



Location and features of Yellowstone National Park.

has a suspension of colloidal silica. With changes in temperature and pressure, and with evaporation, the silica forms a solid called geyserite, a member of the opal family of minerals. This is the material of which the geyser cones and sinter are composed.

In the hot springs the suspension of silica is given credit for one of the special visual effects of the water, a quality of opalescence. Most of the color effects, however, are caused by algae which grow year round in the warm water. Each type of algae is specific to water at a given temperature, and consequently a wide range of blue, green, yellow, orange, and brown colors may occur within a few feet as the water cools.

Most of the geyser activity takes place in saucer-shaped depressions in the lava surface, hence the designation "geyser basins." Upper Geyser Basin, containing Old Faithful, and three adjacent basins immediately to the north (Biscuit, Midway, and Lower Geyser basins) draw the greatest interest. Also on the highway and frequently visited are Norris and West Thumb Geyser basins, and the Dragon's Mouth area in the Hayden Valley. Approximately 200 geysers have been observed and named, though only those in the basins along the road are well known. A great variety may be observed, from towering eruptions of steam to small spurts.

The most famous by far is Old Faithful, unusual both for the regularity of its cycle and the height of its eruption. The cycle rarely takes more than 80 minutes or less than 40; it averages just over 60 minutes. Its eruption is of impressive size and forcefulness, shooting hot water over 100 feet and sometimes almost 200 feet in the air.

**Geological Features and Wildlife.** In two areas of the park there are fossil forests, areas of abundant petrified tree trunks and also many fossil leaves. Yellowstone Lake to the south is an unusually



FRITZ MENLE, FROM PHOTO RESEARCHERS

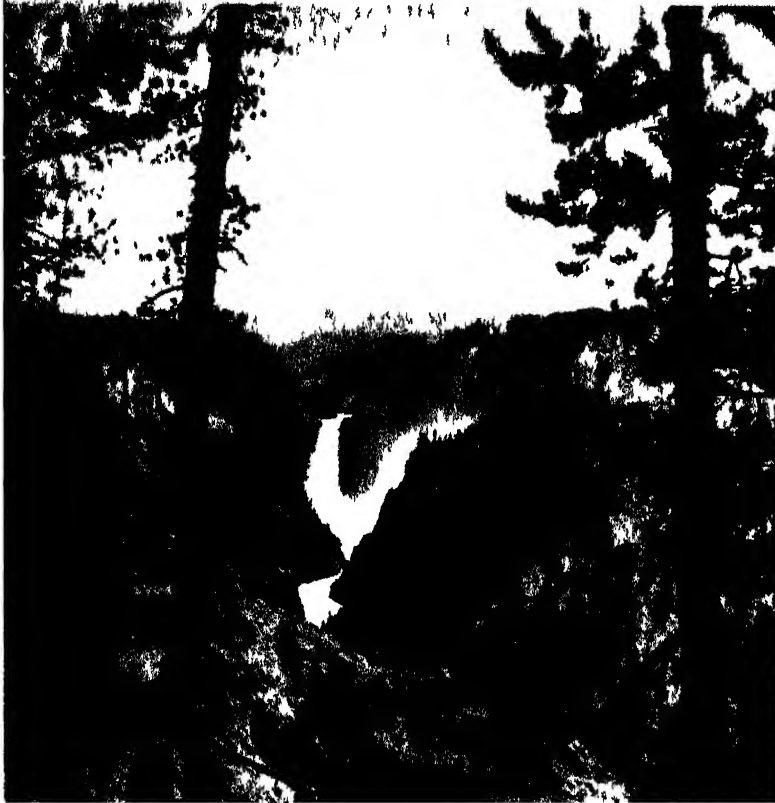
(Above), Pure sulfur coats the floor of Upper Geyser Basin. (Below), Castle Geyser is named for its huge cone, which resembles a hill crowned by the ruins of a castle.

H. LANKS, FROM FPG





# YELLOWSTONE NATIONAL PARK—YELLOWSTONE RIVER



The broad Lower Falls of the Yellowstone River drop 208 feet into the Grand Canyon of the Yellowstone.

© AFTON OLSON, FROM PHOTO RESEARCHERS

large lake for such a high elevation (7,731 feet above sea level). Glaciers, which covered the whole plateau at one time, have left their marks in scoured bedrock and in glacial till and erratics.

Wildlife rivals geology as an object of interest in the park. Fishing is permitted and is very popular in the lakes and streams; trout are taken most often, but some grayling are also caught. Hunting is not permitted, and some wild species may be observed at close range. Antelope, deer, elk, buffalo, coyotes, bear, and several species of waterfowl are often seen. Elk (wapiti) have increased beyond the capacity of the range to support them. With the timber wolf exterminated and the mountain lion almost so, there is no natural check on the elk population short of starvation. Severe control measures, including limited hunting, have had to be taken in some years.

**History.** It was early thought that the park region had been avoided by American Indians. Most of the nearby tribes were superstitious about the hydrothermal activity. But there is increasing evidence of Indian occupancy. One group, the Sheepeaters, lived in the park. Others crossed it regularly and came to secure obsidian for arrowheads and other tools.

The official history of Yellowstone National Park began in 1870 with the Langford-Washburn-Doane expedition. Earlier, "mountain men" had returned from the region with "fantastic" tales that were dismissed as fabrications. In 1870, Nathaniel P. Langford and Henry D. Washburn gathered a small group together to inspect the area and set the record straight. They were joined by Lt. Gustavus Doane of Fort Ellis and a small group of infantry. Needless to say, they found magnificent natural phenomena.

While they were at their last camp in the area, the idea was put forth that this region was too important to divide up for private gain and should instead be set aside for public use. This was the first significant proposal countering the prevailing philosophy that the public domain should be sold or given away in its entirety. During the next two years, with considerable promotion by Langford, the idea caught hold, and on March 1, 1872, by an act of Congress, the Yellowstone National Park area was withdrawn from private entry. In 1886 administration of the park was given to the Army, passing to the National Park Service after the latter was created in 1916.

In the summer of 1988, unprecedented weather conditions and other factors combined to intensify the severity of eight fires—some naturally ignited and some caused by human negligence—that eventually burned over about 1.4 million acres in and around the park. It was estimated that 1,400 acres were burned severely enough to leave them barren. Wildlife in the park was affected less by the fires themselves than by the loss of winter forage. The fires raised complex questions about park service fire-management policy.

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**Further Reading:** Bartlett, Richard A., *Yellowstone: A Wilderness Besieged* (Univ. of Ariz. Press 1983); Chase, Alston, *Playing God in Yellowstone* (Atlantic Monthly Press 1986); Manning, Harvey, *Wildlife in Yellowstone and Grand Teton National Parks* (Superior Pub. 1977).

**YELLOWSTONE RIVER,** river, Montana and Wyoming, a major tributary of the Missouri River, 671 miles long. It rises in the Absaroka

Range in northern Wyoming and flows northward through Yellowstone National Park into southern Montana, where it turns to flow north-eastward to its junction with the Missouri in westernmost North Dakota. Its headwaters are in high mountain wilderness. Within Yellowstone National Park, it creates Yellowstone Lake, one of the largest lakes to be found at so high an elevation. Its canyon, just north of the lake, is one of the great scenic features of the park. Until it reaches Gardiner, Mont., the river's course is so rugged that transportation routes do not follow it, but from Gardiner on to its confluence with the Missouri, it is paralleled by railroads and major highways. Most of the land in the valley floor is irrigated from the river, some of this in large federal irrigation projects. Practically all of the river's tributaries come from the south, such as the Stillwater, Clark Fork, Bighorn, Tongue, and Power rivers.

NICHOLAS HELBURN  
University of Colorado

**YELLOWTAIL**, a marine fish—a species of jack, *Seriola dorsalis*—widely distributed in warm waters of the Pacific Ocean. The species is also known as Pacific yellowtail, and California yellowtail, and in the New Zealand–Australia region as the yellowtail kingfish. It is a popular sport fish along the coast of southern California and Mexico, and it is also important commercially. It has a bright yellowish bronze band from snout to tail, yellowish fins, and a yellow tail.

The name "yellowtail" is sometimes given to an unrelated species, the Atlantic snapper, *Ocyurus chrysurus*.

**YELLOWWOOD**, a name applied to several trees and shrubs, including *Cladrastis lutea*, a small tree of the Leguminosae, or legume family. Rare and local in occurrence, it is found in the mixed hardwood forests of Tennessee, Kentucky, and southern Missouri, although its complete geographical range includes western North Carolina, southern Indiana, southern Illinois, northern Georgia, northern Alabama, central Arkansas, and northeastern Oklahoma. Under optimum conditions for growth, the tree may attain a height of 60 feet (18 meters) and a diameter of 24 inches (46 cm) or more. Yellowwood is identified by its smooth, silvery gray-brown bark; alternate, deciduous, pinnately compound leaves, each with 5 to 11 leaflets; long chains of white, locustlike, fragrant flowers, each with a bright red ovary; small, linear, 4- to 6-seeded podlike fruits; and winter twigs of varnished appearance.

Yellowwood is not important to the timber economy of the United States. The hard, bright gold wood has been used locally for the production of gunstocks and for fuel and at one time was a commercial source of a yellow dye principle. The species is drought resistant and is quite hardy far north of its natural range. Open-grown trees develop pleasingly symmetrical crowns that, when in full flower, are of great beauty. Called "virgilia" by horticulturists, yellowwood is used as an ornamental but should not be used in regions where sleet storms are common, as its limbs are brittle. The species is easily grown from seed and may be propagated from fall root cuttings stored in cool, moist soil during the winter.

E. S. HARRAR, *Duke University*

**YELTSIN**, yel'tsën, Boris Nikolayevich (1931– ), Soviet political leader. He was born on Feb. 1, 1931, in Sverdlovsk province. A civil engineer, he joined the Communist party in 1961 and came to national attention with his 1978 appointment as first secretary of the Sverdlovsk regional party committee, which carried with it membership in the all-Union Central Committee in Moscow. He became known for his executive ability and for having the courage of his convictions. Named head of the Moscow party organization by Mikhail Gorbachev in 1985, Yeltsin was soon elevated to the Politburo. However, his aptly career ended abruptly, late in 1987, when he attacked the slow pace of reform under Gorbachev. Stripped of his posts, he was relegated to a ministerial job, but in semi-free, all-Union parliamentary elections early in 1989, he won a seat from Moscow by a landslide.

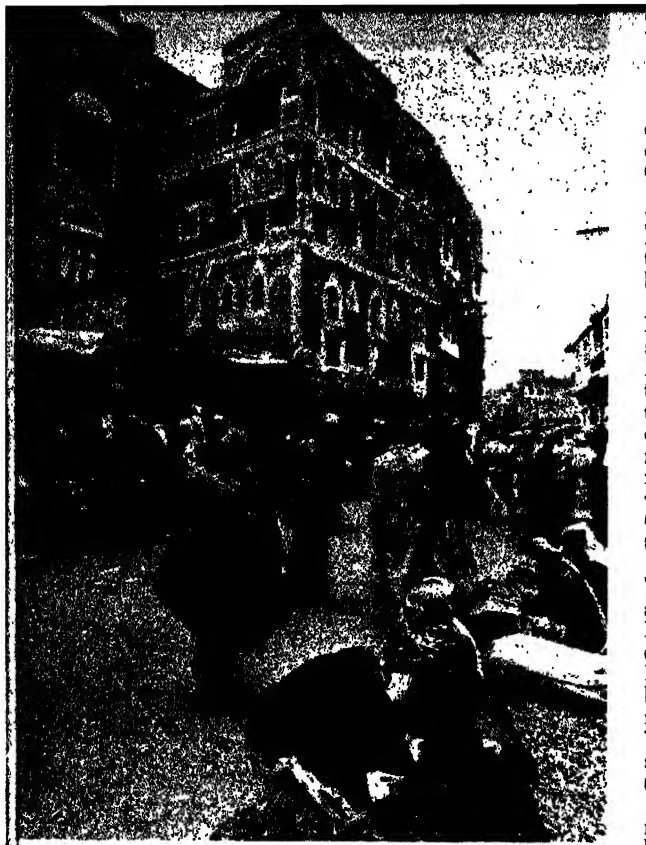
In March 1990, Yeltsin won an easy victory in the parliamentary election of the Russian republic. In May, despite opposition orchestrated by Gorbachev, he was elected president of the Russian republic by its legislature. He was quickly recognized as the most popular political figure with the Soviet public, eclipsing Gorbachev. In July, Yeltsin stunned the country by resigning from the Communist party at its Congress. He set up a young, pro-reform government in the Russian republic and led its declaration of sovereignty. Open challenges to Gorbachev followed—on Lithuanian independence, and over control of banking and natural resources in the Russian republic. In late summer, Yeltsin drew enthusiastic crowds as he began his huge, campaign for the first direct, popular election of the republic's president, which he won in 1991. His message was on the need to confederate the USSR, privatize property, and rapidly "marketize" the economy. Thanks largely to Yeltsin's efforts, a hard-liner coup against Gorbachev failed in August 1991. As a result, Yeltsin became de facto co-leader of the USSR with Gorbachev.

ROBERT SHARLET, *Union College*

**YEMEN**, People's Democratic Republic of, yem'an, a former country on the southern coast of the Arabian Peninsula. Known as Southern Yemen until 1970 and sometimes referred to as Yemen (Aden), it consisted of the city of Aden and its surroundings and the former British Protectorate of South Arabia (earlier called the Aden Protectorate). It ran along the coast of Arabia for some 700 miles (1,100 km) and in places reached about 200 miles (320 km) inland. The islands of Perim (at the mouth of the Red Sea), Kamaran (off the coast of the Yemen Arab Republic), and Socotra (some 200 miles, or 320 km, off the southern coast) also belonged to the republic.

Because of a disputed border with Saudi Arabia, estimates of the country's size varied. One frequently cited figure was 128,560 square miles (332,968 sq km). The capital of the country was the port city of Aden. The sandy coast was arid. The land farther inland became mountainous and was crossed by wadis, or riverbeds that filled with water only after a rain. The northeast was desert. The climate was extremely hot, and rainfall was less than 3 inches (76 mm) annually.

The population of the country was recorded at 2,345,266 in the 1988 census. The majority lived along the coast. The language of the country was Arabic, the religion Muslim. The people were primarily farmers and nomadic herders.



CLAUDE SALHANI/SYGMA

Ancient Sana, capital of the Yemen Arab Republic, became the capital of a united Yemen in 1990.

The subsistence crops raised included sorghum, sesame, millet, wheat, barley, and dates. The chief cash crop was long-staple cotton. Oil had been discovered, and there was an oil refinery in Aden. The country's exports included petroleum products, cotton, hides and skins, coffee, and dried fish.

Prior to the closing of the Suez Canal in 1967 during the Arab-Israeli War, Aden was one of the world's busiest bunkering ports. It was the chief port of call for traffic between Europe and the Indian Ocean and the Far East. Its importance was greatly diminished by the closing of the canal. The port fell into disrepair, and this important source of foreign currency dried up. Aden did not fully recover after the reopening of the canal in 1975.

**History.** In ancient times, Aden was a port for the incense and spice trade between East and West. The area came under the sway of Islam in the 7th century A.D. For a time it formed part of the Ottoman Empire. In 1839 the British seized Aden, to guard the route to India. Gradually the British extended their control inland and eastward. Ultimately the British protectorate included more than 20 sultanates, emirates, and sheikhdoms.

Under British sponsorship, several states in the Protectorate of South Arabia formed a federation in 1959; three years later it became the Federation of South Arabia. In 1963, Aden adhered to the federation, but the large sultanates in the eastern part of the protectorate, called the Hadhramaut, refused to join.

In 1967 the National Liberation Front (NLF) undermined the federation and overthrew many

of the rulers in the protectorate. Independence came on Nov. 30, 1967, and the head of the NLF, Qahtan al-Shaabi, was elected president.

On June 22, 1969, Qahtan al-Shaabi was deposed in a bloodless coup by a group of young leftists. It was to be the first of several coups in the years to come, reflecting the political instability of the country.

Chronic border warfare with the Yemen Arab Republic alternated with discussions about possible unification. Even though that country held Democratic Yemen responsible for the assassination of its president in June 1978, unification talks were resumed less than a year later. Democratic Yemen's successive Marxist governments maintained close ties with the Soviet Union, from which it received substantial aid and to which it granted military prerogatives on its soil. On May 22, 1990, the two Yemens united to form the Yemeni Republic. See also YEMENI REPUBLIC.

**YEMEN ARAB REPUBLIC**, a former country situated in the southwestern corner of the Arabian Peninsula. It was bounded on the north by Saudi Arabia, on the east and south by the People's Democratic Republic of Yemen, and on the west by the Red Sea. In dispute was much of its northern and eastern boundary. The area of the Yemen Arab Republic was estimated at 75,290 square miles (195,000 sq km) and its population (1986 census) was 9,274,173.

**Physical Features.** The land consisted of a narrow coastal strip and an extensive hinterland of broken highlands. The coastal lowland, the Tihama, extended 20 to 30 miles (30–50 km) inland from the Red Sea. It was humid, hot, and sterile, with a few scattered oases. The highlands rose to an elevation of 12,336 feet (3,760 meters). Rainfall varied from 15 to 30 inches (400–800 mm) annually. Summers on the highlands were relatively temperate, and winters were cool, giving the area the best climate of the entire Arabian Peninsula. Sana, the official capital, was situated on a plateau more than 7,000 feet (2,130 meters) above sea level. Taiz, the former royal residence, had an elevation of 4,500 feet (1,370 meters). The two principal seaports were Hodeida and Mocha.

**The People.** Unlike other Arabians, the Yemenis were settled, and there were hardly any nomads. They also differed in being mostly Shiites of the Zaidi variety, a moderately dissident Muslim sect that comes closest to the majority Sunnites. Most of the lowlanders are Sunnites of the Shafi rite. Some 50,000 Jews, mainly from Sana, emigrated to Israel shortly after it won independence in 1948. Roughly, the people consisted of (1) aristocrats (sayyids, lords), who were descended from the Prophet Mohammed and were considered custodians of the Muslim religion; (2) tribespeople, mostly in the highlands; and (3) a mixed population along the coast with a strong African element. Literacy was low, about 15%. Education followed the traditional model, centering in mosques or mosque schools. A modern graded school system was introduced after World War II and was conducted largely by Egyptian and Palestinian teachers.

**Economy.** Agriculture in the highlands and trade along the coast were the chief occupations of the people. The land contained some of the most fertile areas of the Arabian Peninsula, its terraced slopes, receiving enough rain to make cultivation possible. Sorghum, millet, wheat,

barley, and maize (corn) were grown in the highlands, as well as potatoes, tomatoes, grapes, apricots, and peaches. Two major crops of this area were coffee, once the country's chief source of foreign exchange, and khat (*qat*), a popular narcotic stimulant consumed by chewing the leaves or drinking a brew made from them. As farmers discovered that khat for the domestic market yielded the more reliable profits, they diverted to it much land from coffee for export. Cotton, tobacco, and dates were grown in the lowland. Mineral production included petroleum and salt. Among the handicraft industries were leatherworking and sword making; in the modern manufacturing sector were oil refining and cotton textile weaving. Before the 1960's, transportation depended largely on pack animals. Afterward the road system was improved, permitting motor vehicle traffic between main towns.

**Government.** Until September 1962 the government of Yemen was an absolute monarchy with patriarchal features; the law was that of the Koran. Yemen was one of the few Muslim lands that had not been opened to modernizing influences. The imam Ahmad ibn-Yahya (reigned 1948-1962) was head of the Zaidi sect and temporal and spiritual leader of all the people. Uprisings aimed at reform were all suppressed. Following an unsuccessful coup in which a brother of the king was involved, Ahmad in 1956 initiated a council of state (cabinet), in which his son Crown Prince Saif al-Islam Muhammad al-Badr became minister of foreign affairs and minister of defense. The imam himself held the premiership. Under the republic established in 1962, the army dominated the government. However, a military council gave way in 1978 to a popular assembly, which afterward elected a president with executive powers.

**History.** Yemen, a part of classical Arabia Felix, was the earliest seat of Arabian culture, dating from the early part of the first millennium before Christ. It saw the rise and fall of three major peoples, the Minaeans, Sabaeans, and Himyarites. Its prosperity was due to the cultivation of spices, frankincense, and other semitropical products in demand around the eastern Mediterranean basin. With the rise of Islam the country formed a part of the caliphate, and later of certain successor states of the caliphate. In 1517, following the destruction of the Mamluk Empire by the Ottoman Turks, Yemen was occupied by the Ottomans.

The modern kingdom of Yemen had its inception in 1904, when Imam Yahya Hamid al-Din revolted against the Ottomans, but it did not achieve full independence until 1918, at the end of World War I. Yahya's conflict with King Abdul-Aziz ibn-Saud was resolved in 1934, when the disputed area of Asir was officially lost to Saudi Arabia. After that, Yahya styled himself king. He was murdered in 1948 and succeeded by his eldest son, Ahmad. Under him, Yemen's claim to sovereignty over Aden and the Aden Protectorate was repeatedly pressed, resulting in clashes with the British. In 1945, Yemen joined the League of Arab States and two years later the United Nations, and in 1958 it established a loose federation with the new United Arab Republic. After Syria's secession from the republic in September 1961, Yemen's tie was also broken. Technical aid had been provided by the West as well as by the Soviet Union and Communist China.

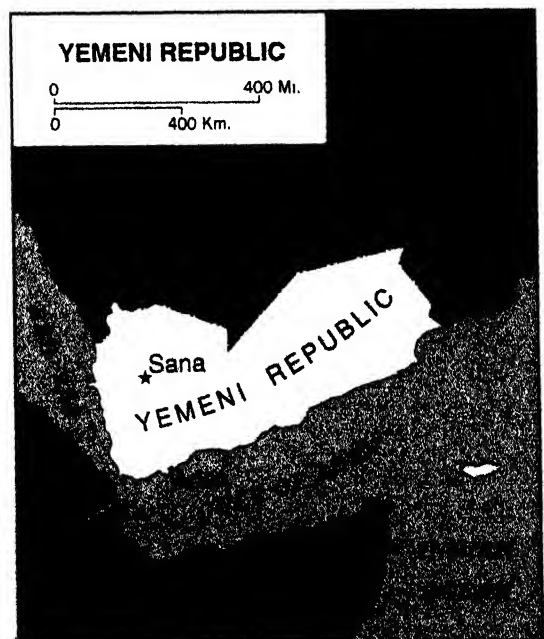
On Sept. 27, 1962, only a few days after the accession of al-Badr to the throne vacated by the death of his father, Ahmad, a military coup overthrew the monarchy and a republic was proclaimed. The leader was Abdullah al-Salal, who became president of the republic and received substantial aid from Egypt. Royalists, faithful Zaidis, and tribesmen rallied to the king's support, with Saudi Arabian backing. In 1967, Egyptian troops in Yemen at Salal's request were withdrawn because of war with Israel, and he was deposed by other republican leaders. By 1970, after withstanding a royalist siege of the capital, the government had reached an accommodation with most royalist groups and the Saudis. However, the country remained unstable until after Lt. Col. Ali Abdullah Saleh came to power in 1978.

The Yemen Arab Republic (YAR) and the People's Democratic Republic of Yemen engaged in intermittent border warfare while nonetheless exploring the possibility of their unification. Saleh obtained military and other aid from the USSR, but also from the United States. The economy, dependent on Saudi assistance and on receipts from Yemenis working in Arab oil-producing countries, was adversely affected by the downturn in world oil prices. Paradoxically, it was bolstered by the subsequent discovery of oil in the YAR itself. On May 22, 1990, the two Yemens finally united, forming the Yemeni Republic. See YEMENI REPUBLIC.

PHILIP K. HITTI\*

*Author of "The Middle East in History"*

**YEMENI REPUBLIC**, yem'-ə-nē, a country in the southwestern part of the Arabian Peninsula. It was formed on May 22, 1990, by the merger of the Yemen Arab Republic (North Yemen) and the People's Republic of Yemen (South Yemen). The country has an area of approximately 203,850 square miles (527,968 km) and a population (1990) of about 13 million. The capital is Sana; the economic center is the port of Aden.



Unity was achieved despite fundamental differences in the government of each country. North Yemen, the more populous, was dominated by the traditions of tribe and Islam, whereas South Yemen had a Marxist government that promoted modernism and secularism. South Yemen, however, had eased its commitment to Marxist principles before the merger.

President Ali Abdullah Saleh of North Yemen was elected president of the Yemeni Republic by the parliaments of both countries. The legislatures chose Ali Salem al-Baidh, secretary-general of the ruling Socialist Party of South Yemen, as vice president. A five-member governing council contained, besides the president and vice president, one southerner and two northerners. In a referendum boycotted by Islamist groups, a constitution was approved in May 1991.

The government hoped to increase the production and export of oil, found in both Yemens in the 1980s. For favoring Iraq in the Persian Gulf crisis and war (1990-1991), the Yemeni Republic had 1 million of its guest workers expelled from Saudi Arabia. See also YEMEN, PEOPLE'S REPUBLIC OF; YEMEN ARAB REPUBLIC.

**YEN Li-pen.** See YAN LIBEN.

**YENAN.** See YAN'AN.

**YENBO.** See YANBU.

**YENISEI RIVER,** yen-ə-sā', in the Russian republic of the USSR. One of the longest rivers in the Soviet Union, it forms in effect the boundary between the West Siberian lowland and the Central Siberian uplands. Although the Yenisei system has a total length of about 2,500 miles (4,000 km), the river proper commences at the confluence of the Bolshoi Yenisei and the Maly Yenisei rivers, near Kyzyl in the Tuva ASSR, and flows generally north for over 2,000 miles (3,200 km) into Yenisei Gulf in the Kara Sea, an arm of the Arctic Ocean. Its basin occupies an area of over 1 million square miles (2.6 million sq km).

The upper Yenisei, from Kyzyl to Abakan, is shallow and full of rapids. The middle course, from Abakan to the mouth of the Angara below Krasnoyarsk, widens to 9 miles (14 km) and deepens to 30 feet (9 meters). The lower Yenisei, from the Angara River to Yenisei Gulf (over 1,200 miles, or 1,900 km), is from 6 to 25 miles (10-40 km) wide and, below Turukhansk, from 45 to 75 feet (14-23 meters) deep with a current of only 1.8 to 2.5 miles (2.9-4 km) an hour. In its lower course, the Yenisei is strengthened by three turbulent, right-bank tributaries: the Angara (Upper Tunguska), which drains Lake Baikal; the Middle Tunguska; and the Lower Tunguska.

Because of the severe Siberian climate, the upper Yenisei is frozen from mid-November to the end of April; the lower Yenisei, from October to the beginning of June. The abrupt onset of spring in the south causes rapid melting of the snow and a sharp rise in the river's flow. Floating ice often piles up downstream, raising the water level as much as 50 feet (15 meters) and causing severe flooding.

Though entirely navigable, the river has little traffic in its upper course. A canal, linking the Kas and Ket rivers, connects the Yenisei with the Ob River to the west.

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**YENTAL.** See YANTAL.

**YEOMAN,** yō'mən, a term of Middle English origin, probably a contraction of "young man" and used first to denote a retainer of a king or nobleman. The yeoman in Geoffrey Chaucer's *Canterbury Tales* represents this meaning. Later the term came to be applied to small farmers—particularly, in England, to the small freeholders, who ranked below the gentry. The term is also used as a rating for petty officers and certain others in the British and U.S. navies.

**YEOMEN OF THE GUARD,** yō'mən, in England, a corps of veteran soldiers employed on state occasions in conjunction with the gentlemen-at-arms as the bodyguard of the sovereign. The yeomen were constituted a corps in 1485 by King Henry VII, and they still wear the costumes of that period. The officers of the corps are a captain (ordinarily a peer), a lieutenant, and an ensign—all army officers. There are also a "clerk of the cheque" and four "exons," besides noncommissioned officers (messengers, sergeants major, yeoman hedgoers, yeoman bedhangers), and 100 privates. The yeomen constitute the oldest military body in England. Their dress is striking: a red tunic, faced and striped with purple and ornamented with gold lace; red knee breeches and red stockings; a ruff and a plumed hat; a steel gilt halberd with a red-and-gold tassel; and an ornamental sword. They are commonly known as Beefeaters, a name also used for the warders of the Tower of London, who wear a similar dress.

**YERBA MATÉ.** See MATÉ.

The uniform of the Yeomen Warders of the Tower of London closely resembles that of the Yeomen of the Guard.



BRITISH TOURIST AUTHORITY



**YEREVAN**, ye-re-vân', the capital of the Armenian republic in the Transcaucasian region of the USSR. It is situated on the Zanga (Razdan) River, which drains Lake Sevan into the Aras (Araks) River. Protected by the Gegamski Mountains on the north, Yerevan looks out over the fertile Aras Basin, with Mt. Ararat clearly visible 35 miles (55 km) to the south in Turkey. The city is connected by a branch line to the Tbilisi-Leninakan-Nakhichevan railway and has an airport.

The climate of the upland basin is characterized by cold winters, hot summers, and relatively low precipitation. A dense network of irrigation canals makes it possible to cultivate orchards and vineyards, rice, cotton, and hemp in the fields outside the city. Yerevan is the major manufacturing center of Armenia, supplied with power from the system of hydroelectric stations, known as the Zanga cascade, built by the Soviets along the Zanga River as it drops over 3,000 feet (900 meters) from Lake Sevan to the Aras. Chief among the city's manufactures are aluminum, synthetic rubber and tires, machinery, small hydroturbines, cables, chemicals, textiles, wines, and canned fruits.

Yerevan is one of the oldest cities of the Caucasus, important during the Middle Ages because of its location on a major trade route leading from the Black Sea to India. During the Russo-Persian War the city was taken by the Russians in 1827. From 1828 to 1840 it was the center of the new Armenian oblast, and in 1850 it became the center of Yerevan Guberniya. Soviet power was established in Yerevan in November 1920, and it became the capital of the newly formed Armenian Soviet republic. Since then the city's character has been transformed by industry, and at the same time it has been turned into an impressive cultural center, enriched by monuments in the architectural style of the past. Yerevan State University was founded here in 1920. Population: (1979 census) 1,019,000.

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*University of Washington*

**YERKES**, yûr'kêz, **Charles Tyson**, American financier: b. Philadelphia, Pa., June 25, 1837; d. New York, N.Y., Dec. 29, 1905. The son of a Philadelphia bank president, he started as a brokerage clerk in that city at age 17, established his own stockbroking firm at 21, and opened a banking house three years later. After failing in the panic of 1871, he was imprisoned for refusing to give preference to the city of Philadelphia over his other creditors, but was pardoned after seven months. Yerkes soon recouped his losses and in 1882 moved to Chicago, where he acquired a controlling interest in the street-railway system. His methods of financial and political manipulation became a public scandal, however, and he was compelled to sell out in 1899. He subsequently headed a syndicate engaged in building the London underground. Yerkes lived in magnificent style, with mansions in Chicago and New York City. In 1892 he donated funds to the University of Chicago for the construction of the Yerkes Observatory. His career was the basis for Theodore Dreiser's novels *The Financier* (1912), *The Titan* (1914), and *The Stoic* (1947).

**YERKES**, yûr'kêz, **Robert Mearns**, American comparative psychologist: b. Breadysville, Bucks County, Pa., May 26, 1876; d. New Haven, Conn., Feb. 3, 1956. He graduated from Ursinus

College in 1897 and took his doctorate at Harvard in 1902. Even while a graduate student, he began his extensive body of scientific publications on comparative psychology, his first studies dealing with the behavior of invertebrates. Yerkes directed the laboratory of comparative psychology at Harvard until 1917 and during these years published research on the behavior of many organisms, from the worm to the great ape. During World War I he took a major role in developing tests of intelligence that were given to more than 1,700,000 men in the United States Army. This was the first large-scale application of scientific psychology ever attempted, and the results were eminently successful.

Following the war, Yerkes assisted in organizing the National Research Council and in 1924 joined the faculty of Yale University, where he remained for the rest of his career. He became the world's greatest authority on the behavior of the higher primates and in 1930 established an experimental station for the study of great apes. This station, located at Orange Park, Fla., was renamed the Yerkes Laboratories of Primate Biology in his honor in 1942.

Yerkes believed that comparative psychology is a method of research, not a separate field of study, and his vigorous curiosity led him also into work on human psychology. Whether dealing with lower animals or with humans, he sought to describe both the biological and the psychological aspects of the organism, and hence referred to his work as psychobiology.

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**YERKES OBSERVATORY.** See OBSERVATORY.

**YESENIN, Sergei Aleksandrovich.** See ESENIN, SERGEI.

**YESHIVA**, ya-shê'vâ (plural, yeshivot), the oldest form of higher Jewish learning, established after the destruction of the second Temple in Jerusalem (70 A.D.) for the purpose of elaborating upon the meaning of the Hebrew Bible. These interpretations were subsequently compiled in the Talmud. The earliest yeshivot were founded in the 3d century in the Land of Israel (Palestine) at Yavne, Caesarea, Tiberias, and other cities and notably in the Babylonian centers of Sura and Pumbedita. A number of others were founded elsewhere in the Middle East and in the Mediterranean and North African area between the 3d and 6th centuries. Subsequently, Jews built yeshivot in western and central European countries between the 8th and 15th centuries.

Owing to persecutions, expulsions, and the decimation of Jewish communities during various Crusades, yeshiva centers were shifted to eastern Europe, primarily Poland, Lithuania, and Russia, where they flourished from the 16th century to the 20th. The curriculum of these schools focused essentially on the study of the Talmud and its commentaries. The yeshiva in Volozhin trained many of the rabbis and talmudic scholars of the 19th century.

The master of a yeshiva was called *rosh* (head of) *yeshiva*. Many young men became lifelong students of rabbinic and talmudic literature. Some were married, often quite young, and lodged and supported in houses provided by the schools. Upon completion of the program of study, such scholars were granted *semichah* (or-

dination) and given the title *rav* (rabbi) or *morenu* (our teacher). Although the Bible is written in Hebrew and the major portions of the Talmud commentaries are in Aramaic, the language of instruction was Yiddish in most of central and eastern Europe.

The yeshiva movement in Europe ended with the Holocaust. A number of schools, however, were revitalized and others established in the new state of Israel, particularly in Jerusalem and Bene Beraq. A noteworthy innovation, the *yeshivot hesder* (post-high school academies) combined rabbinic and talmudic studies with military service.

In North America the earliest yeshivot were the Yeshibath Eitz Chaim (1886) and the Yeshivath Rabbi Isaac Elchanan (1896), both in New York City. These schools merged to become the nucleus of Yeshiva University.

A 20th century development, the Jewish day school, arose in Orthodox communities as a way to combine Judaic religious with secular academic studies on the elementary and high school levels. The typical curriculum usually includes instruction in the Hebrew language for proficiency in reading the original sources, Bible study, and intensive analysis of the Talmud. This is complemented by a full program of secular academic studies, in accordance with local and state requirements for general education. In most Orthodox yeshivot the sexes usually are taught separately, with somewhat different emphases for females, although coeducation is commonly permitted in the elementary grades of the modern Orthodox schools.

Conservative and reform congregations and groups also founded day schools (not identified as yeshivot). These schools are coeducational.

ALVIN I. SCHIFF, *Executive Vice President*  
*Board of Jewish Education*  
*of Greater New York*

**YESHIVA UNIVERSITY**, yə-shē'və, a private liberal arts institution, the main campus of which is situated on the upper west side of New York City. It is the oldest and largest independent university founded under Jewish auspices in the United States.

The university offers a broad range of courses leading to bachelor's, master's, and doctoral degrees. The undergraduate schools emphasize general studies complemented by courses in Judaic lore. The graduate schools prepare students in medicine, law, social work, psychology, Jewish education, and Semitic languages, literatures, and cultures.

Undergraduate men study at the main (up-town) center; undergraduate women at the mid-town center, which includes Stern College and a teachers institute.

Well known in their fields are the Albert Einstein College of Medicine (1955), the Benjamin N. Cardozo School of Law (1976), and the Belfer Institute for Advanced Biomedical Studies (1978). An affiliate, the Rabbi Isaac Elchanan Theological Seminary, prepares students to be Orthodox rabbis and confers ordination.

The university traces its origin to Yeshiva Eitz Chaim (1886), which merged with the Rabbi Isaac Elchanan Theological Seminary (1896) to form Yeshiva College in 1928. The college was granted university status in 1945.

**YETI.** See ABOMINABLE SNOWMAN.

**YEVREISKAYA AUTONOMOUS OBLAST.** See JEWISH AUTONOMOUS OBLAST.

**YEVTUSHENKO**, yef-tə-sheng'kō, *Yevgeni Aleksandrovich* (1933— ), Russian poet. He was born in Zima, Siberia, on July 18, 1933. Shortly after his birth his family moved to Moscow. But during World War II he was evacuated to Zima, where he began to write. He returned to Moscow in 1944. Yevtushenko's first poem was published in 1949, and his first volume of poetry, *The Prospectors of the Future*, appeared in 1952. He gained national recognition with his second book, *Third Snow* (1955), which was followed by a long autobiographical poem, *Winter [Zima] Station* (1956).

The rebellious attitudes reflected in some of Yevtushenko's poetry, although they provoked attacks by more orthodox Soviet writers and critics, won him great popularity, and his poems were soon translated into many languages. The first English translation of Yevtushenko's work was published in 1962 as *Selected Poems*. It included *Babi Yar* (1961), a bitter indictment of Soviet unconcern over the Nazi massacre of the Jews of Kiev.

In 1960, Yevtushenko began a series of trips abroad, visiting Africa, Europe, and the United States. In 1962, while in Paris, he published in French translation *A Precocious Autobiography*. Its somewhat unfavorable portrayal of conditions in the USSR prevented its publication there and led to an official rebuke by Premier Khrushchev. In 1965 appeared the long poem *Bratsk Station*, a meditation on history whose symbolic centerpiece is a Siberian power station. *Stolen Apples*, a collection of poems, was published with English adaptations by James Dickey, John Updike, and others in 1971.

Yevtushenko's first novel, *Wild Berries*, was issued in 1982. He also took up acting and wrote for the stage. The cinematographic effects of *Fuku* (1985), an autobiographical work in poetry and prose, reflects his writing and directing for motion pictures. In English translation *Fuku* was published in his collection *Almost at the End* (1987).

**YEW**, yōō, the common name for any of the species of *Taxus*, a genus of evergreen shrubs and trees, in the family Taxaceae. Although the leaves are needlelike, as in many conifers, and resemble some of the species of firs and hemlocks in their flattened two-ranked effect, the yews are not true conifers since their fruits (arils) are bright red and berrylike. Although usually dioecious (male and female flowers on separate plants), yews sometimes have both sexes on different branches of the same plant.

Yews are particularly valued for their horticultural possibilities. Varieties most often cultivated are from the Japanese yew (*T. cuspidata*) and the hardier English yew (*T. baccata*), the latter being more popular in the southern United States. The English yew is found from England to western Asia; the Japanese yew occurs in the Orient. Horticultural forms of these two, and hybrids, range from low compact shrubs to basket-shaped bushes with long spreading branches or tall, narrowly columnar forms (the latter called Irish yew). Yews are especially valued for hedges, since they stand clipping well and produce a dense, dark green growth. For the same reason they have been used in formal gardens, especially

in England, for trimming or training in ornamental shapes. Because of their dark green color, long life, adaptability to various soils and degrees of moisture and shade, and their relative freedom from insects and disease, the yews are considered excellent garden subjects. There are also native American species, but these are not as often used horticulturally. In eastern North America there is *T. canadensis*, commonly called ground hemlock, a shrub with spreading branches; in the West, *T. brevifolia*, in most places a rather leggy tree, but sometimes reaching a height of 80 feet (24 meters); and in the South, *T. floridana*.

The tough, resilient wood of yew trees was valued for bows wherever it was found; the longbows of the English were made of yew when possible, and the Scottish botanist David Douglas (1798–1834), on an early collecting expedition in America, reported that the Indians on the Columbia River favored the Western American yew for their bows. With the modern revival of interest in archery, yew wood is still used for this purpose and is sometimes used also for canoe paddles and in cabinetwork and turning.

Yews have traditionally been used as symbols of long life and even immortality. When palms were not available on Palm Sunday in England, yew was sometimes substituted. Old churchyards and cemeteries usually had a yew tree growing in them, and some of these trees reached a great age. Early poems on death frequently mentioned "sad ewe." Yews are reputed to be more or less poisonous in all their parts, often fatally so; the poisonous property (due to an alkaloid known as taxine) was so well known that "slips of yew" are part of the witches' brew in *Mucheth*.

**YEZD.** See YAZD.

**YEZIDIS.** See YAZIDIS.

**YGGDRASIL**, ig'drə-sil, in Norse mythology, the name of an ash tree whose branches extended up into the heavens and whose three roots were thrust far into the nether world. This cosmic tree has parallels in other religious systems and may conceivably go back to common Indo-European beliefs; but in the form of the myth preserved in the Old Icelandic sources it has absorbed memories of sacred groves, and myths about the Cross of Christ.

While the sources do not entirely agree on its exact nature, it is clear that this tree symbolized all existence and was a vital poetic element in Norse belief. Its name means "the bearer of Odin" and is a metaphor for the gallows on which Odin is said to have hung for nine days, a sacrifice to himself. The tree itself is exposed to "more anguish than men can know," for its roots are gnawed by serpents and its leaves by four stags, symbolizing apparently the endless conflict between life and death. An eagle sits on the topmost bough. Under its spreading branches the gods met in solemn conclave and drank from the sacred well of Urd, or Fate. Thomas Carlyle was much enchanted by this myth and expanded on it in his *On Heroes, Hero-Worship, and the Heroic in History* (1841).

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**YI DYNASTY.** See under KOREA—History.

**YIDDISH LANGUAGE**, yid'ish, a language used by many Jews of European origin. It has been spoken for almost a thousand years and until the eve of World War II was the most widely used modern Jewish language. Most speakers of Yiddish today live in the United States and Canada, the rest in Israel, the Soviet Union, France, Australia, South Africa, Britain, and Latin America.

**Origins.** Yiddish arose about the 10th century among Jewish immigrants from France and Italy who settled in the Rhineland region of western Germany. In its earliest form Yiddish was a blend of Middle High German city dialects with Jewish varieties of Old French and Old Italian along with many words and usages of Hebrew and Aramaic origin. Thus, from its very beginning, Yiddish was a language separate and different from medieval German. Its next major development occurred in the 14th century with the eastward migration of masses of Jews escaping the double scourge of the Crusades and the Black Death. As a result Yiddish broke away from German influence and came directly under the sway of Slavic languages. Contact with Czech, Polish, Ukrainian, and Russian not only flooded Yiddish with thousands of Slavic words but deeply affected its grammar, syntax, sound and stress pattern, and semantics. The language flourished in the small towns and villages of eastern Europe where Jews lived in virtual isolation for centuries. By the 19th century, when anti-Semitism forced millions of Jews to leave eastern Europe for the United States and other countries, Yiddish had developed a great religious and secular culture and had, in effect, become the lingua franca, or international language, of most Jews of European origin throughout the world.

**Characteristics.** Linguists often speak of Yiddish as a fusion language, in reference to the unique synthesis of Germanic, Romance, Semitic, and Slavic elements in its structure. These diverse elements, intimately and seamlessly fused, have given Yiddish its notable ability to express many subtle shades of meaning and emotion (irony, wryness, sarcasm, condescension, scorn) in a wide variety of ways, usually with an overlay of self-deprecating humor.

The language's basic grammar, sound system, and vocabulary are drawn from Germanic sources. Into this structure is built the Hebrew-Aramaic component (comprising about 18% of the lexicon) and the Slavic component (about 16%). In the manner of most Jewish languages, Yiddish uses the Hebrew alphabet and is read from right to left. There are no capital letters in the writing system.

**Dialects.** Formerly, Yiddish was divided into two major dialectal groups, Western and Eastern. Western Yiddish was widely spoken in Germany, the Netherlands, and other countries west of Poland until about 1700. It then began a process of decline that by the end of the 20th century seemed nearly complete.

Eastern Yiddish, on the other hand, developed into a number of regional dialects. The most important are: Northeastern, spoken in Lithuania, Latvia, and Belorussia; Southeastern, spoken in the Ukraine, Romania, and eastern Galicia; and Central, spoken in Poland and western Galicia. A speaker of Northeastern Yiddish is usually called a *Litvak* ("Lithuanian"). One speaking Central or Southeastern Yiddish is often called a *Galitsyaner* ("Galician"). Both terms of course are misnomers.

## COMMON YIDDISHISMS IN ENGLISH

**bagel**—A crusty roll shaped like a doughnut.  
**chutzpa**—Brazen gall; nerve.  
**ganef**—A thief; crook.  
**kibitz**—To look on and offer unsolicited advice.  
**maven**—An expert or connoisseur.  
**megillah**—A long, involved or tedious story.  
**nebbish**—Ineffectual; pitiful.  
**-nik, suffix**. One who is, does, etc., as in *no-good-nik, peacenik*.  
**nosh**—A snack or nibble.  
**nudnik**—A tiresome person; nuisance; bore.  
**schlemiel**—A clumsy, bungling person.  
**shamus**—A private detective.  
**shlep**—To drag.  
**shlock**—Shoddy; inferior.  
**shm-** prefix. Used to reduplicate a word in deprecation, as *fancy-schmancy, old-shmold*.  
**shtick**—A routine; act.  
**zaftig**—Plump; buxom.

The most significant difference between the dialects is in the vowels. For example, in Northeastern Yiddish the words for "go to sleep" are *gey shlofn*; in Central Yiddish they are *gay shlufn*; in Southeastern Yiddish they are *gey shlufn*. The pronunciation of Southeastern is usually intermediate between Northeastern and Central. But Standard Yiddish is closest to the Northeastern dialect in pronunciation; grammatically it is closest to Central Yiddish.

**Yiddish and English.** Yiddish was transplanted in the United States and Britain in the 1880's by Jewish immigrants from eastern Europe. During the next 40 years it thrived on American and British soil as the principal language of Jews at home and in the streets. Especially in the United States, Yiddish cultural activity found intense expression in poetry, fiction, drama, journalism, and scholarship. Nevertheless, the masses of working-class Jews longed to become Anglicized or Americanized as quickly as possible. Their Yiddish became slovenly, filled with English words that replaced perfectly good Yiddish ones. They began to look upon Yiddish as inferior, immigrant "jargon," hardly a language.

This attitude led to a steady decline in the use of Yiddish after the 1930's, paralleling the erosion of other immigrant languages in English-speaking countries. With the decline, however, a nostalgia for the old *mame-loshn* ("mother tongue") set in, and the English of the American-born children of the immigrants began to be peppered with Yiddish words and usages. Because of the special expressiveness of Yiddish, dozens of words and expressions found their way into colloquial American English (see box).

After World War II tens of thousands of Yiddish-speaking immigrants from Europe entered the United States. Their arrival injected new blood into the dying language. Among the newcomers, Hasidic and other Orthodox Jews kept up the use of Yiddish in their everyday life. A new variety of Yiddish-influenced English among American Jews of eastern European origin or descent came to be known as "Jewish English." Furthermore, interest in Yiddish revived among third-generation descendants of immigrants. Yiddish courses were introduced in many colleges and universities. New Yiddish plays were staged and Yiddish "klezmer" music gained popularity. The language thus continued to play an integral and active role in American Jewish culture.

SOL STEINMETZ, *Author, "Yiddish and English: A Century of Yiddish in America"*

**YIDDISH LITERATURE**, literature in the Yiddish language created by northern European Jews (Ashkenazim). Germany and northern Italy were the medieval and Renaissance literary centers, but eastern Europe became dominant by the 18th century. Modern Yiddish literature developed as a self-conscious, aesthetic expression in the late 19th century. The years 1860 to 1914 spanned the "golden age." Later, the decimation of European Jewry in World War II, the near liquidation of Soviet Yiddish culture by 1948, and the acculturation of Jews in the Americas severely limited creativity in Yiddish.

**Old Yiddish Literature.** Earliest examples are epic fragments and biblical poems found in a 1382 codex. The twin sources of the poems are German popular literature and Hebraic religious texts. Typical works are the knightly romance *Bovo-Bukh* (1541) by Elia Levita; the biblical epic *Shmuel-Bukh* (1548) by Moshe Esrim Vearba; and the *Mayse-Bukh* (1602), a collection of moral tales. In Poland, Jacob ben Isaac Ashkenazi created the *Tsena Urena* (1616), a popular homiletic work for women. Glueckel of Hameln (1664–1724) wrote unique *Memoirs* chronicling German-Jewish family life.

Hasidism developed a literature about their rabbis, such as *Shivhei Ha Besht* (1815). Nachman of Bratslav's tales *Sippurei Masiot* (1815), fusing folk narrative and Hasidic lore, became a major source for modern Yiddish literature.

Literature of the Haskalah, the Jewish Enlightenment, appeared in the late 18th and early 19th centuries. Its first eastern European adherents were Mendel Lefin and Joseph Perl, both rationalists, who attacked Hasidism in satires. Other leading Haskalah writers were Isaac Mayer Dik, Israel Aksenfeld, Shlome Ettinger, and Abraham Baer Gottlober.

**Modern Yiddish Literature.** Mendele Mocher Sforim, of Russia, is traditionally regarded as the "grandfather" of modern Yiddish literature. His verve, portraiture, and style influenced the development of Yiddish prose. Notable among his works are *The Little Man* (1863), *Fishke the Lame* (1869), and *The Mare* (1873), which depict downtrodden Jews, and the picaresque *Travels of Benjamin the Third* (1878).

Sholom Aleichem, of both Russia and the United States, is considered by many the most original and popular Yiddish author. Prolific in all genres, he developed a tragicomic humor fusing elements of the grotesque with empathy. His vast array of personages provide a broad picture of everyday Jewish life, as in the epistolary series *Menachem Mendl* (1894–1895). His best-known work, *Tevye the Dairyman* (1899), captures through comic and despairing monologues the dislocations of the *shtetl* world and served as a source of the musical *Fiddler on the Roof*.

Isaac Leib Peretz, of Poland, is the third "classic" author. Seeking authentic folk matter, he rewrote hitherto scorned Hasidic legends into sophisticated short stories, such as *Hasidic Tales* (1908) and *Folktales* (1909). He also wrote plays for the Yiddish stage.

Yiddish poetry began with the wedding bards and folk poets. Mikhl Gordon of Poland and Shimon Shmuel Frug of Russia mark the transition into conscious artistry. In the United States it was the "sweatshop" poets of New York, David Edelstadt, Yosef Boshover, Morris Vinchevsky, and above all Morris Rosenfeld, who voiced the aspirations of the immigrant laborers.

A literary group, Di Yunge (1907–1926), established the Yiddish lyric as a personal, aesthetic genre stressing form and effect. Their main journal, *Shrifn* (1912–1926), published Dovid Ignatov, the novelist; Ruvin Iceland, a fine miniaturist; and the humorist Moshe Nadir. Mani Leyb fused form, musicality, and mood in intense sonnets. I. I. Shvarts' *Kentucky* (1925) was an epic of a Jewish peddler. The most original poet was Moshe Leyb Halpern, whose ironic, self-deprecating, and strident style continues to shock. The best Yunge novelist was Yosef Opatoshu with *In Polish Woods* (1921).

New writers from Kiev brought a subtlety of style in prose never again equaled. Dovid Bergelson's masterpiece *After All Is Said and Done* (1913) portrays a heroine trapped between *shtetl* ennui and vapid city modernity. Der Nister constructed symbolic satires inspired by the tales of Nachman of Bratslav, and his novel cycle *The Family Mashber* (1939–1948) combined realism with Hasidic symbolism. World War I ended the golden age of Yiddish literature.

**Soviet Yiddish Literature.** The Russian Revolution unleashed Yiddish creativity in every genre. Bergelson and Der Nister drew new talent to their journal *Ours* in Kiev. Three major poets emerged: Dovid Hofshiteyn, Leyb Kvitko, and Perets Markish. Their verses resonated with Nietzschean freedom and nature worship. Theoretical debate flourished, pitting Bergelson against the Bolshevik critic Moshe Litvakov, who demanded that Jewish art serve the Revolution.

Moscow, Kiev, and Minsk were the main centers of Soviet Yiddish literature. In Moscow a literary group formed about the journal *Shtrom*, with its international Modernist perspective. Influenced by Russian Symbolism and Futurism, the original group included the prose writers Y. Dobrushin and Shmuel Godiner and the poets Aron Kushnir and Dovid Hofshiteyn. Under their aegis were brought together such Yiddish figures as Shmuel Rosin, E. Fininberg, the nostalgic Shmuel Halkin, the party poet Itsik Fefer, and the Minsk poets Z. Akselerod and Izi Kharik. Their major themes were pogroms, nostalgia for the *shtetl*, urbanism, and belief in the future.

Soviet Yiddish prose in the 1920's moved to Socialist Realism in the works of Shmuel Persov and Itsik Kipnis. The 1930's brought strict conformity: "Soviet in content, Yiddish in form." Even Bergelson and Der Nister conformed. The poet Moshe Kulbak produced a masterpiece, *Zelmenyaner* (1931, 1935), portraying a Jewish family adapting willy-nilly to Soviet realities. The Great Purge of 1937 destroyed Kulbak, the Minsk writers, and even Moshe Litvakov, head of the Communist daily *Truth*. In 1948 all Yiddish cultural institutions were closed. Many Yiddish writers were arrested and shot in August 1952. In 1961 the Soviet government permitted one journal to appear, *Soviet Homeland*, with Aron Vergelis as editor in chief.

**Poland and Eastern Europe.** Moshe Broderzon and his Yung Yiddish group (1919) brought Modernism to Poland, which by 1922 expanded into full-blown Expressionism in Warsaw. Dubbed The Street Gang, this avant-garde electrified Jewish Poland with the violent verse of P. Markish, the apocalyptic vision of Uri Tsvi Grinberg, and the neoprimitivism of Melekh Ravitch. The major themes were the agony of war, pogroms, the dismal present, and the sad future. Other participants were the realist novelists Oyzer Var-

shavsky (*The Smugglers*, 1920) and I. J. Singer (*The Brothers Ashkenazi*, 1935). Sholem Asch wrote of life in Poland (*Mottke the Thief*, 1917) and in New York (*Uncle Moses*, 1918).

By the late 1920's Modernism waned. The besieged Jewish worker became a key theme for the Expressionist Israel Rabon (*The Street*, 1928). Isaac Bashevis Singer made his debut with his best novel, *Satan in Goray* (1935), a forerunner of magic realism. A Cubist Modernist woman poet, Dvoreh Fogel, linked The Street Gang to Yung Vilne, the last literary movement in Poland. The most talented poets were Leyzer Volf, Hirsh Glik, and the Surrealist Abraham Sutskever. This Vilna world was later chronicled by Chaim Grade in *The Agunah* (1961).

In the ghettos of World War II Yiddish literature continued. Fragments of poems by Miriam Ulianofer remain. Yitskhak Katsenelson's *The Song of the Murdered Jewish People* (1944) survived intact. Y. Y. Trunk escaped to complete his prose epic *Poland* (1944–1953).

Two of the greatest Yiddish poets emerged in Romania: Eliezar Shteynberg, with his witty, pessimistic *Fables* (1932), and Itsik Manger, whose lyric ballads *Madresh Itsik* (1935–1936) retell Bible stories in 1900 folk settings.

**The United States.** The poet H. Leivik appeared in the United States (1918) with strong verse, combining Jewish messianism and personal suffering. His verse play *The Golem* (1920) became a classic of the theater and cinema. Leivik encouraged the Introspectivists, who created a Modernist Yiddish American movement fusing Imagism, Futurism, and Expressionism. Two key poets, Aron Glantz Leyeles, a master of fixed form and chief theoretician, and Yankev Glatshteyn, the quintessential Modernist, wrote the manifesto (1920). Joined by N. B. Minkoff, Celia Dropkin, Anna Margolin, and A. Lutzky, their poetry caught the vitality of the American experience. In the 1930's, Abo Shtoltsenberg, Judd Teller, Shloyme Shvarts, and Berish Vaynshteyn, a proletarian Expressionist, appeared. The Holocaust turned poets back to their roots, to remember and to lament. Kadia Molodovsky captured her grief in prickly verse, and Glatshteyn became nationalistic. After World War II, creativity in Yiddish waned. Even the Nobel laureate Isaac Bashevis Singer ceased writing for the newspaper *The Forward*, once the publisher of almost every Yiddish writer.

**Israel: The Last Echo.** Poets such as Yosef Papiernikov, Arye Shamri, and the woman poet Rikudah Potash were the rare pioneers using Yiddish in the 1930's while helping to rebuild Israel. In 1949 the Vilna survivor Abraham Sutskever, the last major poet, created *The Golden Chain*, the last important Yiddish literary journal with a worldwide readership. Immigrants from Russia and elsewhere, such as Moshe Yungman, the mystic Yankev Fridman, Rokhl Boymol, and Shloyme Roitman, renewed their song in the new land. A Yung Yisroel group developed, including Rokhl Fishman, Rivka Basman, and Assia. A single publishing house remained.

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**Further Reading:** Harshav, Benjamin and Barbara, eds., *American Yiddish Poetry: A Bilingual Anthology* (Univ. of Calif. Press 1986); Howe, Irving, and Greenberg, E., eds., *A Treasury of Yiddish Stories* (Schocken 1977); Liptzin, Sol., *A History of Yiddish Literature* (Jonathan David 1972).



**YIDDISH THEATER.** The origins of theater in Yiddish can be traced to the traditional merrymaking that accompanied the celebration of the Jewish festival of Purim. This gave rise to the Purimshpil (Purim play), about the deliverance of the Jews of Persia from extermination threatened by Haman, the prime minister, through the intercession of Esther, the beautiful Jewish queen of King Ahasuerus. Lighthearted dramatizations of the biblical book of Esther and other legends are mentioned as far back as early talmudic literature. Full of comedy and mime, the Purimshpil was first performed by amateurs and yeshiva students and later by traveling troupes of actors and jesters, and continued to gain popularity until the 18th century.

Other than the cantor, synagogue choir, and *badkhanim* (wedding jesters), the Purimshpil constituted the main form of entertainment among the Yiddish-speaking eastern European Jews. By the mid-19th century the Jews of Europe, having achieved degrees of emancipation and enlightenment, began to look beyond the limited scope of the Purimshpil, setting the stage for the birth of professional Yiddish theater.

Beginning in the mid-19th century, the emerging Haskalah (Jewish Enlightenment movement) found its theatrical expression in the popular Yiddish language of the masses. Much of the early repertoire centered on the struggle between tradition and progress, Old World values and modern European society.

In the early 1860's a group of entertainers, based in the Galician city of Brod and known as the Broder Singers, mimed and clowned their way through the Russo-Polish pale of Jewish settlements. Their typical act combined the wit of Jewish wedding jesters with the slickness of Viennese café entertainers.

Modern Yiddish theater was born in a Romanian wine cellar in the town of Jassy in 1876 with a two-act improvisation by the actor, playwright, and composer Abraham Goldfaden. His earlier appearance in the title role of Dr. Solomon Ettlinger's *Serkele* (1862) marked the beginning of an illustrious theatrical career for Goldfaden, who starred in many of his own musicals and eventually became universally acknowledged as the father of the modern Yiddish theater.

While still in its formative years, Yiddish theater was forced out of its home by the restrictions and pogroms initiated by Czar Alexander III of Russia in 1881. Beginning in 1883, Yiddish theater followed its audience in a mass migration to western Europe and the Americas. By the turn of the century, New York City, with its burgeoning population of immigrant Jews, became the center of Yiddish theater in the New World.

The first professional performance of a Yiddish play in New York took place in Turner Hall in the summer of 1882 with Goldfaden's *The Witch*. In the cast was young Boris Tomashevsky (1868–1939), a Ukrainian-born actor who later opened the People's Theater with his own production of Goldfaden's play. Tomashevsky paved the way for other celebrated actors-turned-producers, such as Jacob P. Adler (1855–1926) and David Kessler (1860–1920), all three of whom were revered as virtual culture-heroes in the Jewish community. Blessed with a huge and passionate immigrant audience, Yiddish theater experienced intense competition among the various companies that sprang up in the free environment of the New World.

On New York's Second Avenue, for example the early Yiddish theater was attended mainly by working-class immigrants, whose enthusiasm outweighed their sense of decorum. As the productions were often as long as five hours, the theatergoers would fortify themselves with bags of food, which they consumed with gusto while voicing critiques of the performances.

The arrival in the United States of Jacob Gordin (1853–1909) from Russia marked the beginning of the "golden age" of Yiddish theater in New York. Gordin waged battle against the sentimental melodramatic offerings of *shund* (low brow) and championed *kunst* (art) theater, which aspired to higher standards of writing and performance and a respect for the written word. During his tenure, Gordin changed the face of the Yiddish theater, writing nearly 80 plays, including such classics as *Mirele Efros*; *God, Man, and the Devil*; and *The Jewish King Lear*, one of his many adaptations of Shakespeare.

Inspired by the writings of Mendele Moche Sforim, Sholom Aleichem, and I. L. Peretz, Yiddish theater continued to grow and mature. Also influential in its development were the works of Sholem Asch, Leon Kobrin, David Pinski, Peretz Hirschbein, and H. Leivik, as well as such non-Jewish masters as Chekhov, Ibsen, Strindberg, Hauptmann, and Gogol.

In the years between the World Wars, Yiddish theater flourished throughout the world. In Poland the Warsaw Yiddish Art Theater operated side by side with the Yung Theater. In the Soviet Union the Moscow State Yiddish Theater founded by Alexander Granovsky, boasted the talents of set designer Marc Chagall and the consummate actor-director Shloyme Mikhoeles. Yiddish theater companies thrived in London, Paris, Bucharest, Buenos Aires, and Johannesburg. The most prestigious ensemble was the Vilna Troupe, founded in 1916. In 1919 it presented the world premiere of S. Ansky's *The Dybbuk*, which became the classic masterpiece of the Yiddish theater.

Second Avenue on New York's Lower East Side was at its peak with more than a dozen Yiddish theaters, including Maurice Schwartz' Yiddish Art Theater, launched in 1918, and the ARTEF (Arbeter Teater Farband), founded in 1925. One of Schwartz' most memorable productions, in which he also played the title role, was I. J. Singer's *Yoshe Kalb*, an immediate success and a staple of the Yiddish theater repertoire.

Among the acting luminaries of the early Yiddish theater were Jacob P. Adler, Sigmund Mogulesco, Jacob Ben-Ami, David Kessler, Bertha Kalish, Keni Lipzin, and Esther-Rokhl Kaminska. A later generation of stellar performers included Adler's children Celia, Stella, and Luther, Rudolph Schildkraut, Ludwig Satz, Joseph Buloff, Menasha Skulnik, Leo Fuchs, Zvi Scooler, Seymour Rechtzeit, Muni Weisenfreund (Paul Muni), Ida Kaminska, Jenny Goldstein, and Molly Picon.

During the dark years of the Holocaust, Yiddish theater followed its people into the ghettos where it became a symbol of spiritual resistance, especially in Warsaw and Vilna. After World War II, Yiddish theater came to life in the Displaced Persons camps in western Europe and later in the newly established State of Israel.

The demise of the Yiddish theater has been predicted as often and with as much passion as that of the Yiddish language, but phoenix-like

both the language and its theater have experienced a rebirth. A renewed interest in Yiddish and eastern European Jewish culture has again made New York City the center of a revitalized Yiddish theater. Indicative of this resurgence is the continued viability of the Folksbiene (founded in 1915), the oldest Yiddish theater company in the United States, the Shalom Theater (featuring Mary Soreanu), and the Joseph Papp Yiddish Theater, which launched a successful opening season in the fall of 1988.

JOSEPH PAPP, MIRIAM HOFFMAN,  
RENA B. BOROW  
*The Joseph Papp Yiddish Theater*

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**YIN SHAN**, yin shān, a mountain range in the Inner Mongolian Autonomous Region of China, extending in an east-west direction and rising generally to 6,500 feet (2,000 meters) above sea level. To the north is the Gobi desert; to the south are the great northern bend of the Yellow River (Huang He, Hwang Ho) and the irrigated Hetao (Hot'ao) Plain.

The Yin Shan contains rich deposits of coal and iron ore. These resources account for the development of one of China's largest iron-and-steel complexes at Baotou (Paot'ou, Paotow) on the Yellow River bend. The coal also supplies power plants in the area.

**YIN-YANG**, yin'yang', a term used in Chinese philosophy to indicate the active and passive principles of the universe. The yang or male force represents the light, active, generative essence. The yin or female force represents the dark, passive, receptive essence. From their interaction all things come into existence and are dissolved.

**YINGKOU**, ying'kō', a city in China, in the Northeast (Manchurian) province of Liaoning, about 100 miles (160 km) southwest of Shenyang. It is situated on the Hun River, near the mouths of the Hun and Liao rivers, which empty into the Gulf of Liaodong. Although it is the natural outlet for the grain, soybeans, and coal of the Liao Valley, its port is handicapped by rapid deposition of sediments and during the winter by ice blockage. An important oil field adjoins the city limits.

Yingkou (Ying'ou, Yingkow) prospered after 1836 when it took over the trade of the silted upriver port of Niuzhuang (Newchwang). It was opened to foreign shipping in 1858 and developed rapidly as the leading seaport of Manchuria. The city remained prominent until the first decade of the 20th century, but extensive Manchurian railroad construction and the attendant rise of the port of Dalian (Talien, Dairen) led to its decline. It began to recover, especially as a shipping point for soybeans, when it was linked by rail with Manchurian main lines before World War II. Yingkou then became a center of light industry, with food-processing plants, cotton-textile mills, and wood-pulp factories. After the war the Communist government established some heavy industry in the city, notably machine-tool manufacture and petroleum refining. Population: (1982 census) of the municipality, including rural areas, 419,640.

**YLANG-YLANG**, ē'lāng-ē'lāng, a tropical tree (*Cananga odorata*) of the custard-apple family (Annonaceae), related to the papaw. The Ylang-Ylang (Ilang-ilang) is not impressive as an ornamental, being sparse and awkward, with drooping branches and oblong leaves that are glossy above and hairy beneath. The tiny yellowish flowers have an unusual fragrance and are sometimes used in Hawaiian leis. The genus *Cananga*, which means "flower of flowers," is native to Malaya and has only a few species. But the ylang-ylang has been widely planted in China, India, the Pacific Islands, and the American tropics. Flowers are gathered for perfume, especially in Réunion, Nossi-Bé, Madagascar, and the Comoro Islands. The aromatic oil, obtained by steam distillation, consists of a mixture of several exquisite floral fragrances. It is said, too, to reduce blood pressure in warm-blooded animals and is even substituted for quinine in the treatment of malaria. Cananga oil was introduced into Europe about 1864 and was in great demand for production of perfume.

**YMCA.** See YOUNG MEN'S CHRISTIAN ASSOCIATION (YMCA).

**YM-YWHA.** See YOUNG MEN'S AND YOUNG WOMEN'S HEBREW ASSOCIATION (YM-YWHA).

**YMIR**, ē'mir, in Norse mythology, a giant who came into being in the primordial world chasm by spontaneous generation between cold and heat. According to the poems of the *Elder Edda* and Snorri Sturluson's *Younger Edda*, he was the first living creature and became the ancestor of the race of giants. Fed by the cow Audhumla, he was killed by the first gods, Odin and his two brothers, Vili and Ve. From his flesh they made the earth, from his blood and sweat the seas, from his bones the mountains, from his teeth the gravel and stones, from his hair the trees, from his brains the clouds, and from his skull the sky. The name Ymir means "the roarer," but the origin of the story is obscure.

EINAR HAUGEN  
*Harvard University*

**YO-YO**, yō'yō, a simple toy consisting of a grooved double disk with a string wrapped around the center. The player holds the end of the string, which unwinds as the disk is dropped; then, by slight jerks on the string, it can be made to rewind, bringing the disk back to the hand. Hence the yo-yo is also called a return top. In 18th century England a similar top was known as the quiz or the prince of Wales' toy. In France it was called the bandalore; there was also an ivory counterpart known as the *émigrette*, because it was a favorite with émigré nobles driven from Paris during the French Revolution. The toy is said to have originated in China.

**YODEL**, yō'dəl, a type of joyful singing native to the Alpine regions of Switzerland and the Austrian Tirol. The name (German, *Jodel*) probably derives from the Latin *jubilare*, meaning "to shout with joy." Yodeling is characterized by decorative, wordless passages in which production of the voice is alternated rapidly between the low (chest) register and falsetto, the break between the two being marked by a light glottal stroke. A yodel, or a song to be yodeled in part, is often called a tyrolienne.

**YOGA**, yō'gā, a Sanskrit word signifying union of the individual soul with the Supreme Spirit and the disciplines for its attainment. It covers a wide field of spiritual practices adapted to different temperaments. *Karma-yoga*, suited to active minds, deals with the performance of duty, in which the doer renounces attachment, motive, and result; *jñāna-yoga*, for philosophical minds, teaches how to discriminate between the real and the unreal and renounce the unreal; *bhakti-yoga*, meant for emotional minds, shows the way to cultivate love of God for His own sake, without hope of reward or fear of punishment; and *rāja-yoga*, suited to the introspective, deals with self-control and mental concentration. The final aim of all these yogas is liberation of the soul from the bondage of matter. *Hatha-yoga* deals mainly with physical exercises.

Rāja-yoga constitutes what is generally known as Yoga, one of the six systems of Hindu philosophy. It is set forth in the *Yogasūtras* ascribed to Patanjali, a sage who flourished during the 2d century B.C. The Yoga and Sāṃkhya systems accept the same philosophical doctrines regarding such matters as cosmology, psychology, and liberation. They agree that man's bondage results from identification of the soul with the body and that his liberation is attained through the knowledge of their separateness. Unlike Sāṃkhya, which is nontheistic, Yoga admits devotion to God as a help to meditation. The God of Patanjali however, is neither creator nor rewarder and punisher, but a special person untouched by misery, desire, or action and its results. Omniscient, He is the teacher of the ancient teachers. Devotion to God is to be cultivated through repetition of the mystic syllable *Om (Aum)* and reflection on its meaning. The soul's essence, pure intelligence, is obscured by mental activities, whose suppression is the main purpose of Yoga. The mind is to be controlled by constant practice of meditation and nonattachment to

material objects. The ultimate result is the suppression of all mental tendencies, conscious or latent.

Yoga lays down eight steps to achieve this end: *yama* (control) and *niyama* (religious observances) are mainly ethical disciplines; *āsana* (posture) and *prāṇāyāma* (regulation of the breath) give the student physical fitness for further Yogic practice; *pratyāhāra* consists in restraining the sense organs from their objects; next come the mental Yogic disciplines—*dhāraṇā* (holding the mind to a particular object), *dhyāna* (the unbroken flow of awareness of that object), and *samādhi* (complete absorption in the idea behind the object, to the exclusion of its form or outer part). While practicing concentration, the yogi acquires various supernatural powers that belong to the worldly state and must therefore be discarded as obstacles to Yoga. In the end the mind itself is dissolved, and the isolation (*kaivalyam*) of the soul from the body is realized. The disciplines of Yoga have been accepted by all schools of Indian philosophy, including the Buddhist and Jaina.

SWAMI NIKHILANANDA

Editor and Translator of "The Bhagavad Gita"

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A yogi, or follower of yoga disciplines, adopts an immobile posture to isolate his mind from bodily functions.

Associated Press Photo of India



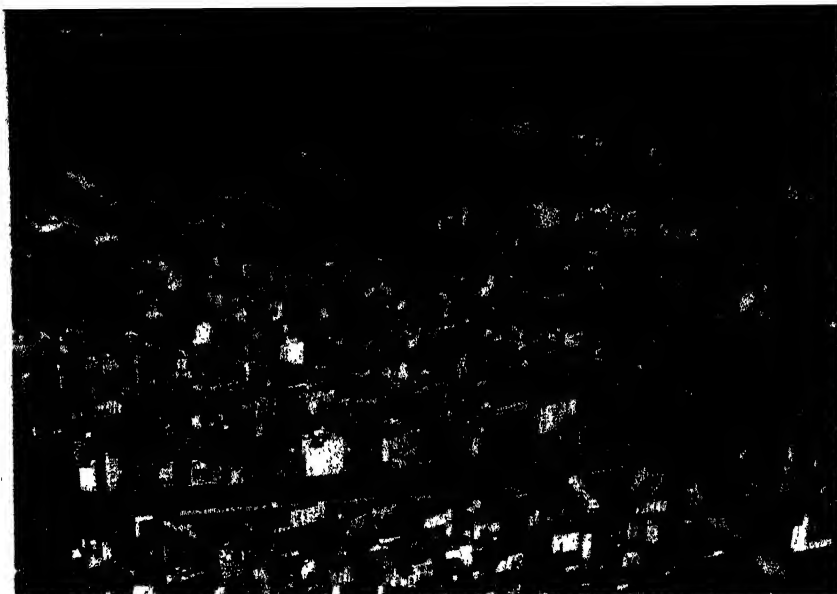
**YOGURT**, yō'gort (also YOGHURT or YOGHOURT), a fermented, slightly acid, semisolid cultured milk food that derives its modern vogue from the Balkans, where it has long been popular. Except for its refreshing taste and wholesomeness as a food, no special virtues were claimed for it until early in the 20th century, when the bacteriologist Élie Metchnikoff, who shared a Nobel Prize in 1908, concluded from his studies on the effect of lactic acid bacteria of the digestive tract that yogurt arrests intestinal putrefaction and thus might be beneficial. Intestinal antibiotic properties are attributed to yogurts which tend to restore the normal intestinal equilibrium.

In western Europe and the United States, where the food has become increasingly popular, yogurt is made almost exclusively from fresh, homogenized, pasteurized cow's milk, to which are added strong yogurt cultures, *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. The milk is bottled and ferments into yogurt inside the bottle, the culturing process taking place in temperature-controlled incubators.

Yogurt has a custardlike consistency and is eaten with a spoon. It contains a higher percentage of lactic acid than other fermented milks, and it is rich in vitamin B complex.

Fresh yogurt has a tangy, keen, and refreshing taste, somewhat like buttermilk, but neither buttermilk nor sour cream contains the specific culture found in yogurt. In addition to plain yogurt, the product is now available sweetened in several

Yokohama, on the western side of Tokyo Bay, is the second-largest city and the busiest seaport in Japan. It is also an industrial and administrative center.



SHOSTAL ASSOCIATES

flavors and also with preserves.

In the Balkans and the Middle East yogurt is also used in food preparation, but in the United States it is usually eaten as a dessert or snack, with or without fruits or jams. Plain yogurt contains no more calories than milk, and since it is more easily digested than milk, it is an excellent food for people with weak digestions, and also for the aged.

J. E. METZGER,

*President, Dannon Milk Products, Inc.*

**YOGYAKARTA**, yōg-yā-kār'tā, a city in Indonesia and the capital of the special district of Yogyakarta. The city is situated in southern Java at the foot of the volcano Mt. Merapi.

Yogyakarta (formerly Djokjakarta and Jogjakarta) is a cultural and educational center. The skyline of the city is dominated by the 18th century palace of the sultans of Yogyakarta. Part of the palace now houses Gajah Mada University, founded in 1949. The city is also the seat of the Java Institute, which was founded in 1921 to advance the study of Javanese culture. There are several other institutions of higher education and several museums.

Yogyakarta has highly developed silvercraft, wood-carving, and leather-goods industries. It is also a center for the manufacture of batik cloth.

The city was founded in 1749 by Sultan Hamengku Buwono I. In 1755, after the Dutch had divided the kingdom of Mataram into Surakarta and Yogyakarta, the city was the capital of the new Dutch-controlled sultanate under Hamengku. Yogyakarta was the center of a revolt (1825-1830) led by Prince Diponegoro against the Dutch and as such became famous as a stronghold of the Javanese independence movement. From 1945 to 1949 the city was the temporary capital of Indonesia. Population: (1980) 398,727.

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**YOKKAICHI**, yōk-kī-chē, a seaport and industrial center in Japan. The largest city in Mie prefecture, central Honshū, it is situated on the western side of Ise Bay, 23 miles (37 km) by rail southwest of Nagoya.

Yokkaichi was originally a market town. In

the 17th century it became one of the 53 post, or relay, towns on the Tokaido, the main road between Kyoto and Edo (modern Tokyo). Yokkaichi was made a city in 1897 and in 1899 was designated a port for foreign trade, serving in part industrial Nagoya, a function it lost with the improvement of Nagoya Harbor. By 1935, Yokkaichi's factories were producing textiles, chemicals, glass, and foodstuffs. After 1955 large-scale petroleum-refining and petrochemical industries were established, creating a serious problem of air pollution. Yokkaichi is also known for its production of a type of porcelain called Bankoyaki. Population: (1980) 255,442.

GEORGE H. KAKIUCHI

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**YOKOHAMA**, yō-kō-hā-mā, a city in Japan, on the southwest shore of Tokyo Bay, 18 miles (29 km) by rail southwest of Tokyo. Japan's second-largest city and leading seaport, Yokohama also is a major industrial center and the capital of Kanagawa prefecture. The city occupies the eastern end of the Tama dissected uplands and alluvial lowland, with its port on the inner curve of a sand spit.

**History** Yokohama is historically important in the establishment of relations between Japan and the United States. In 1853, Commodore Matthew C. Perry dropped anchor off Uraga, south of Yokohama; on his return visit a year later, his ships anchored at Kanagawa (now part of Yokohama), and the Kanagawa Treaty was concluded, providing for the limited opening of two ports, Shimoda and Hakodate, to American ships. In July 1858 a commercial treaty was signed, including Kanagawa among the six ports to be opened to foreign trade, and in 1859 the shogunate transferred the trading activities to nearby Yokohama, which was then only a small fishing village.

Yokohama grew rapidly as a port after the first railroad built in Japan connected it with Tokyo in 1872, and it became a city in 1889. Its hinterland formerly embraced not only eastern Japan but also much of the central and western part of the country. Its relative importance in foreign trade, however, has tended to diminish, partly because of the rapid growth of shipping facilities in other industrial areas.

On Sept. 1, 1923, Yokohama was almost entirely destroyed by a great earthquake, tidal wave, and fire, and in May 1945 Allied air raids ruined practically all of the business district and half of the harbor facilities. It has since been rebuilt along modern lines. During the occupation of Japan following World War II, the port was taken over by the Allied powers and closed to civilian use. In 1952 it was reopened, and its recovery as a commercial port began, strengthened by its excellent railway facilities and its easy access to Tokyo. Yokohama now serves as a port for transpacific commercial ship traffic.

**Economy.**—At one time Yokohama specialized in the export of raw silk to the United States and other Occidental countries and was known as the "silk port." Tea was another export staple. After 1934, however, cotton goods became paramount, and by 1955 steel and iron ranked as the leading items. Machinery is also an important export, as is the traditional raw silk.

Because of Yokohama's position as a foreign trade center with access to imported raw materials, there is considerable manufacturing, especially in the eastern section where, since 1912, a large shallow offshore area has been reclaimed for industrial purposes. The principal industries are shipbuilding and the manufacture of transportation equipment, primary metals, electrical machinery and equipment, and chemicals. Commercial structures, the customhouse, and prefectural and other official buildings are in the central part of the city, while the western part is residential.

**Points of Interest.**—On the eastern side of Sakuragicho Station, overlooking Yokohama, are three hills, Nogeyama, Iseyama, and Kamon-yama. On Nogeyama is Nogeyama Park, largest in the city, which was created after the great earthquake of 1923. The park has a fine example of Japanese gardening, an open-air theater, a modern concert hall, and a zoo. Nearby stands the Municipal Library. On Iseyama is the Iseyama Daijingu, a Shinto shrine, which is a branch of the great shrine of Ise. Kamon-yama is named after Ii Kamon-no-kami (1814–1860), who was premier for Shogun Iemochi and was active in opening Yokohama to foreign trade. The Prefectural Library and the Music Hall are nearby. Perhaps the most beautiful spot in Yokohama is the Sankeien (Three Glens) Garden, which covers an area of over 40 acres along the shores of Tokyo Bay in the southwestern part of the city. The garden contains many historical buildings brought from other parts of Japan. The three-storied pagoda, over 500 years old, which dominates the park, was brought from the Tomyoji Temple at Kamo, Kyoto. Hassei-den (Hall of Eight Sages) near the Sankeien Garden houses images of Gautama (Buddha), Confucius, Socrates, Christ, Prince Shotoku, and the Buddhist priests Kobodaishi, Shinran, and Nichiren. Another point of great interest is the Kusunokicho Kiln, which produces the famous Satsuma ware (also known as Ryosai or Sumida ware). The kiln, originally founded near Nagoya in the 17th century, was moved near the Sumida River in Edo (Tokyo) in 1848 and finally transferred to its present site following the Meiji Restoration in 1868.

There are four universities in the city: Kanagawa and Kanto Gakuin (both private), Municipal Yokohama University, and Yokohama National University. Eleven miles southwest of Yokohama at Atsugi Station is the famous Kanazawa Bunko

(Library), founded in 1275, which contains many historical books and documents. Also located in the suburbs is Yokohama Dreamland, a Disneylike amusement park. Population: (1981) 2,806,523.

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**YOKOSUKA**, yō-kōs-kā, city, Japan, in Kanagawa Prefecture, on Honshu Island, at the southwest end of Tokyo Bay, 12 miles by rail south of Yokohama. The city developed as an important naval base and arsenal after the Meiji Restoration in 1868. In the eastern part are two fine natural deepwater harbors, Yokosuka and Nagaura, occupying former drowned valleys. Originally Yokosuka was located at the neck of Cape Kachiriki, where the Tokugawa shogunate established a shipbuilding yard in 1866. Then, in 1884, the Meiji government set up a naval station and built ship-repair docks and other naval facilities in Yokosuka and Nagaura bays. Yokosuka became a city in 1907 and gradually absorbed the adjacent towns and villages as the needs of the naval base and arsenal expanded. Because of the narrowness of the coastal lowlands, it has gradually moved up the adjacent hillsides and small narrow valleys, the latter interconnected by many tunnels built for military purposes. After World War II the United States Navy occupied the naval base.

The only important manufacturing industry is shipbuilding, at Uraga, about three miles southeast of the naval base. Nagaura has become a commercial port and a base for ships engaged in fishing, especially whaling operations in the Antarctic Ocean. Within the municipality a few minor agricultural settlements on the uplands grow rice, wheat, and sweet potatoes, and there are some small fishing villages along the coast.

The Yokosuka area contains some interesting historical sites. At Kurihama, just south of Uraga, Commodore Matthew C. Perry formally handed a letter from President Millard Fillmore of the United States to the Tokugawa shogun's representative in 1853, and it was off Uraga that Perry's fleet dropped anchor. In Tsukayama Park are the tombs of William Adams and his Japanese wife. Adams, who was the first Englishman to enter Japan (1600), became adviser and shipbuilder to the first Tokugawa shogun. At Cape Kannon, which is east of the naval base, is the first modern lighthouse in Japan. Population: (1981) 426,270.

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**YOKUTS INDIANS**, yō'kəts, an important division of the Penutian linguistic family, formerly living in the San Joaquin Valley, from the mouth of the San Joaquin River in the north to the foot of the Tehachapi Mountains and the slopes of the Sierra Nevada. The name is Indian for "person." Actually a loose confederation of about 40 closely related smaller tribes, the Yokuts were one of the most numerous California peoples, and their way of life reflects the general cultural pattern of the central Pacific Coast region, with some extremely interesting differences.

Each tribe had a hereditary chief. Villages consisted of a single row of wedge-shaped communal houses thatched with tule, and sweat-houses were in common use. Acorns were a staple food, and small game, including even deer and elk, were captured regularly. The Yokuts



were one of the few tribes to use the dog for food, but they refused to touch the coyote or rattlesnake. The women were chaste, prior to white settlement; marriage was by purchase, and the husband moved into his bride's home. Clothing was scanty; women wore the bark apron common to most California peoples, and often tattooed the face and body. Religious life was moderately organized and many animal spirits were known; shamanism played a very important role in the various rituals. One unique feature was a rattlesnake ceremony, reminiscent of the more elaborate snake dance of the Hopi. Boys were initiated with a jimsonweed or *tolache* ceremonial. The dead were either buried or cremated, and the Yokuts observed the usual annual mourning ceremony, common throughout California, when hundreds of Yokuts congregated to weep, dance, and feast.

Yokuts women wove very fine basketry, making extensive use of quail and woodpecker feather decoration; the famous Tulare gambling trays and Tulare bottleneck baskets are familiar exhibits in many museums. One art peculiar to central California was the manufacture by Yokuts women of a crude pottery, which they may have learned from neighboring Shoshonean peoples. Lake Tulare gave a disproportionate importance to one segment of the confederacy, which became known as Tulareños, or Lake Tulare Indians. Unfortunately, this name eventually became attached to the entire Yokuts group, resulting in considerable confusion.

The Yokuts are a remnant of a once numerous people, whose population at its height probably numbered some 10,000. Continued warfare with the Paiutes, who pressed on them from the east, resulted in some depopulation; but the later and much more disastrous aggression by white settlers, who found the Indians occupying land they wanted, practically exterminated many of the tribes. Today fewer than 600 survive, although in spite of their shrinking population they have managed to retain an extremely high degree of blood purity.

FREDERICK J. DOCKSTADER,  
Director, Museum of the American Indian, Heye  
Foundation, New York City.

**YOM KIPPUR**, yôm kip'ar (Heb. for DAY OF ATONEMENT), the most solemn of all Jewish holidays, occurring on the 10th of Tishri (late September or early October). It is observed with prayer and by complete abstention from food and drink, sexual intercourse, and all work, and concludes the "ten days of repentance" which begins with New Year's Day on Tishri 1. Yom Kippur is of Biblical origin (Leviticus 16; 23:26-32), and down to the destruction of the Jerusalem Temple by the Romans (70 A.D.) it included the dispatch into the desert, "for Azazel," of a scapegoat which was believed to take with it the people's sins. A lengthy description of the elaborate Yom Kippur ritual of the Jerusalem Temple still forms part of the services, which among Orthodox Jews take up the whole day. The rites begin on Yom Kippur Eve (Tishri 9) with the Kol Nidre prayer, originally intended to cancel vows of conversion to Christianity made under duress, but later reinterpreted as referring to vows between man and God. The confession of sins, repeated several times during the day, enumerates only ethical lapses, because only these, not crimes against fellow men, were

believed to be atonable by performing the Yom Kippur ritual. The service ends at sundown on Tishri 10 with the closing prayer (Neilah), on the hopeful note that all who have repented have been inscribed by God into "the Book of Life" for the ensuing year.

RAPHAEL PATAL.

**YON**, yôn, **Pietro Alessandro**, Italian-American organist: b. Settimo Vittone, Italy, Aug. 8, 1886; d. Huntington, N.Y., Nov. 22, 1943. He studied at the Milan and Turin conservatories and at the Academy of St. Cecilia in Rome, where he graduated with a first prize in 1905. He was organist at St. Peter's in Rome from 1905 to 1907, when he went to the United States to become organist of St. Francis Xavier's in New York City (1907-1926, except for a brief interval). From 1926 to his death he was organist of St. Patrick's Cathedral in New York City. Yon also gave many organ recitals in European and American cities. He composed extensively in liturgical and other sacred forms, but his creative gift was not of the order of his ability as an instrumentalist.

HERBERT WEINSTOCK.

**YONEZAWA**, yō-nē-zā-wā, city, Japan, in Yamagata Prefecture, on Honshu Island, 194 miles north of Tokyo. It is surrounded by towering mountains, except in the north. Formerly a castle town of the Uesugi family during the Tokugawa shogunate (1603-1867), it has many antiquities despite disastrous fires in 1917 and 1919, which compelled much rebuilding. The principal industry since the 17th century has been silk weaving, which encourages a surrounding agricultural concentration on mulberries (fodder for silkworms), supplementing rice, fruit, and tobacco. Factories are of the small-scale cottage type, though modern, and their products are of high quality. The Japanese rayon industry also originated here. Six miles west is Onogawa, noted for its hot springs. Pop. (1980) 92,823.

DAVID H. KORNHAUSER.

**YONGE**, yūng, **Charlotte Mary**, English novelist: b. Otterbourne, Hampshire, England, Aug. 11, 1823; d. there, March 24, 1901. She was educated at home. Under the influence of John Keble (q.v.), vicar of the neighboring village of Hursley, she identified herself with the High Church faction—later called Anglo-Catholic—in the Church of England. As her talent developed, Keble urged her to use it to expound her religious views, and she was only too ready to comply. Her first full-length novel, *The Heir of Redclyffe* (1853), was immediately successful, partly because of the very qualities—tearfulness and didacticism—which most daunt later readers. Despite preachiness, however, her stories moved. She branched out into historical romance (*The Lances of Lynwood*, 1855, and others) and added juveniles, biography, popular history, and Scripture readings. She also edited (1851-1899) the *Monthly Packet*, a children's magazine. Her total output was some 160 volumes.

DELANCEY FERGUSON.

**YONGSAN RIVER**, yūng-sān, river, Korea, in South Cholla Province (South Korea). Rising in the mountains north of Tamyang, the Yongsan flows in a southwesterly course for 72 miles past Naju and into the Yellow Sea above the port city

of Mokpo. Its basin of nearly 1,100 square miles comprises most of the area of the productive South Cholla plain.

EDWARD W. WAGNER.

**YONKERS**, yŏng'kärz, city, New York, in Westchester County, on the east bank of the Hudson River, on a hilly terrain overlooking the Palisades of the opposite Jersey shore. Yonkers is both a residential and industrial center, the largest city in the county and fifth largest in New York State. On the south it adjoins Bronx Borough of New York City; on the north and east, Hastings-on-Hudson, the town of Greenburgh, and the communities of Scarsdale, Eastchester, Tuckahoe, Bronxville, and the city of Mount Vernon, all in Westchester.

Yonkers' industries include the world's largest manufacturer of elevators and escalators, dating from 1854, and the largest producer of liquid sugar for industrial purposes. Other products include wearing apparel, nurses' uniforms, plastics, pharmaceuticals, pipe organs, metal and wire products, aerosol valves, and electrical and electronic equipment. The submarine pipeline Pluto, used to carry gasoline to fuel the D-day invasion in World War II, was made in Yonkers, as was the 3,000-mile Styroflex coaxial cable that constitutes the heart of the Distant early Warning (DEW) system. The city is served by federal and state highways, a railroad, and river and oceangoing shipping.

Sarah Lawrence College, for women, and St. Joseph's Seminary (Roman Catholic) are located in Yonkers, as is the Boyce Thompson Institute for Plant Research, opened in 1924. The Sprain Brook Branch of the Yonkers Public Library is an outstanding modern structure. Another point of interest is the Hudson River Museum, in Trevor Park, with three art galleries, a planetarium, and a notable astronomical exhibition hall. St. Andrews Golf Club was organized in 1888 with one of the first golf courses in the United States, and the first unofficial United States Open took place here in 1894. Yonkers Raceway is a nationally famous harness-racing track.

**History.**—Yonkers' history goes back to 1639, when the so-called Keskeskeck Purchase, including approximately the present area of the city, was made from the Indians by the Dutch West India Company. Title passed through the New England Company in 1646 to Adriaen van der Donck, first lawyer and historian of New Netherland, from whose title (jonkheer) the city's name is derived. Frederick Philipse (q.v.) acquired much of the van der Donck land in 1672 and succeeding years and built the first Philipse manor house here in 1682. In 1779, the third and last lord of the manor lost his lands because of loyalty to the crown during the American Revolution. Philipse Manor, a fine colonial building, now open to the public and administered by the New York State Education Department in collaboration with the American Scenic and Historic Preservation Society, houses the priceless Cochran Collection of 69 portraits of presidents of the United States, painted by Gilbert Stuart and other leading artists.

Yonkers was incorporated as a village in 1855 and as a city in 1872. It has had the city-manager form of government since 1940. Population: 188,082.

GRINTON I. WILL,  
Director, Yonkers Public Library.

**YONNE**, yŏn, department, France, in the north central part of the country, which was formed from the old Sénonais region of Champagne and parts of Burgundy (Bourgogne), Orléanais, and Nivernais. The capital is Auxerre. The area is 2,881 square miles. Yonne is bounded by the departments of Seine-et-Marne, Aube, Côte-d'Or, Nièvre, and Loiret, and is named after the Yonne River (q.v.), which flows north-northwest through its entire length. The Armaçon River flows through its eastern section and the Loing River rises in the south. The Puisaye region in the southwest belongs to the Loire Basin. The rolling country of the Ile-de-France, which prevails in the north, gradually gives way to the granitic hills of the Morvan (2,000 feet) in the south-east. The climate is mild, except in the Morvan.

The department produces wheat, cattle, vinegar, and, above all, wine, notably the famous Chablis. Minerals include iron, building stones, lithographic stones, and potter's clay. Textiles, sugar, glass, and glue are manufactured, and wool, ship timber, and charcoal are also produced. There are castles of the Renaissance period an Ancy-le-Franc and Fleurigny, and the large monastic Church of the Madeleine at Vézelay is a masterpiece of the Romanesque style. Chief towns, besides Auxerre, are Avallon and Sens. Pop. (1982) 311,019.

RENÉ GIRARD.

**YONNE RIVER**, river, France, in the central and north-central part of the country, one of the Seine's most important tributaries. Rising on the northern slope of Mont Beuvray in the Morvan, it flows 182 miles north-northwest through the departments of Nièvre and Yonne, joining the Seine at Montereau-Faut-Yonne. Its picturesque course passes Clamecy, Auxerre (head of navigation), Joigny, and Sens. The Nivernais Canal runs alongside between Corbigny and Auxerre. Its tributaries are the Cure, which joins it above Auxerre; the Serein; and the Armançon, which joins it above Joigny.

**YORCK VON WARTENBURG**, yörk'fŏn vār'tau-böörkh, COUNT (Johann Hans David) Ludwig, Prussian field marshal: b. Potsdam, Germany, Sept. 26, 1759; d. Klein-Oels (near Breslau), Oct. 4, 1830. He served in the Polish campaign of 1794, and in 1806 commanded the rear guard of Gen. Gebhard von Blücher's army in the retreat from Jena to Lübeck, where it capitulated. Yorck opposed the reforms that Gen. Gerhard von Scharnhorst and Gen. Neithardt von Gneisenau introduced in the Prussian Army after 1807. During Napoleon I's Russian campaign in 1812, he commanded the Prussian corps and during the retreat, concluded with the Russians at Tauraggen (now Taurage, Lithuania), a neutrality convention (Dec. 30, 1812) for his troops, which became the signal for the rise of Prussia against Napoleon. In the Wars of Liberation Yorck commanded a corps in Blücher's Silesian army. His greatest single military accomplishment was the hard-fought crossing of the Elbe River at Wartenburg on Oct. 3, 1813, which made possible the Battle of Leipzig on October 16–19. On March 9–10, 1814, he helped decisively in the Prussian victory at Laon. He was made a count in 1814.

Hajo HOLBORN  
Author of, "A History of Modern Germany"

**YORICK**, yôr'ík, in Shakespeare's tragedy *Hamlet*, the king's fool, whose skull is apostrophized by Hamlet in Act V. The name Yorick was used by Laurence Sterne in *Tristram Shandy* (1759-67) for the parson, intended as a portrait of himself; and as his author's pseudonym in *A Sentimental Journey* (1768).

**YORITOMO**, yô-rê-tô-mô (in full YORITOMO MINAMOTO), Japanese shogun, founder of the Kamakura shogunate: b. 1147; d. 1199. During the 12th century the local aristocracy in Japan became transformed into a professional military class (the *bushi*). Rivalry between the two most influential *bushi* clans, the Taira and Minamoto, was transmitted to the imperial court in Kyoto, as members of the military aristocracy were used by the court for military and police purposes. In 1160 the Taira defeated and killed Yoshitomo Minamoto, head of the Minamoto clan, and imposed a dictatorship on the court. Yoshitomo's sons, Yoritomo and Yoshitsune (q.v.), were spared death and sent into exile. In 1180 remnants of the Minamoto received a secret call from the court to rid the country of the Taira. Yoritomo succeeded in raising forces in eastern Japan (the Kanto) and under the leadership of several Minamoto generals, notably his half brother Yoshitsune, drove the Taira from Kyoto and ended their power at the Battle of Dan-no-ura in 1185.

Meanwhile Yoritomo consolidated his hold over the Kanto, enlisting all possible *bushi* as his retainers (*gokenin*) and confirming their landholdings. He was granted successively the titles of military governor in chief (*sô-shugo*), general of the right imperial guard (*ukonoe-taishô*), and in 1192 barbarian-subduing generalissimo (*sei-i-tai-shôgun*). He established his headquarters (*bakufu*) at Kamakura and began to exercise increasing control over the country.

Yoritomo did not usurp authority from the imperial court but exercised delegated military and police functions. However, since he was able to appoint his retainers as provincial military governors (*shugo*) and land stewards (*jîtô*), he was in possession of a nationwide organization with far-reaching military and even civil powers. Yoritomo thus set the patterns of military rule which lasted until the mid-19th century and which by the 14th century left the emperor with only ritualistic functions. The two subsequent shogunal lines, the Ashikaga and Tokugawa, claimed descent from the Minamoto.

See also JAPAN-20. *History from the Earliest Times to 1853* (The Kamakura Period: 1185-1333).

JOHN W. HALL,  
Griswold Professor of History, Yale University.

**YORK**, yôr'k, CARDINAL (HENRY BENEDICT MARIA CLEMENT STUART), Jacobite pretender to the British throne: b. Rome, Italy, March 6, 1725; d. Frascati, July 13, 1807. Second son of the Old Pretender (see STUART, JAMES FRANCIS EDWARD), he was probably given the title of duke of York at birth and was baptized by Pope Benedict XIII. He was made a cardinal in 1747, shortly after his elder brother Charles (the Young Pretender) had failed in his invasion of Britain. When Charles died on Jan. 31, 1788, York inherited the Jacobite claim to the crown of Britain, assuming the title of Henry IX, "not by men's wishes but by God's will," as the Eng-

lish of the Latin medal struck for the occasion has it. The amiable cardinal enjoyed high offices and rich benefices, but at the French Revolution his revenues dried up, and he fled to Venice. George III gave him a yearly pension of £5,000. After the Concordat of 1801, Cardinal York returned to Rome, and Pius VII made him dean of the Sacred College and bishop of Ostia and Velletri. At his death the male line of the royal house of Stuart-descendants of Robert II, king of Scotland (1371-1390)—became extinct. The cardinal's will bequeathed some of the British crown jewels to the prince of Wales, the future George IV. See also JACOBITES.

WALLACE BROCKWAY.

**YORK, DUKES OF**, in the English peerage. The title was first held by EDMUND OF LANGLEY (1341-1402; surnamed for his birthplace, King's Langley, Hertfordshire), fifth son of Edward III. Edmund received the title from his nephew Richard II in 1385, but as regent in 1399 he deserted to Henry, duke of Lancaster, also a nephew, who defeated Richard and assumed the throne as Henry IV. Edmund's elder son, EDWARD OF NORWICH (1373?-1415), 2D DUKE OF YORK, a shifting politician, was crushed to death at the Battle of Agincourt. Edmund's grandson, RICHARD PLANTAGENET (1411-1460), 3D DUKE OF YORK, was the first to use the surname Plantagenet, no doubt to emphasize his descent from the Angevin kings, whose ancestor, Geoffrey of Anjou, had used a sprig of the broom plant (*planta genista*) as his personal emblem. Deeming his own claim to the throne superior to that of the Lancastrian Henry VI (York was descended from the third son of Edward III; Henry VI from the fourth), York in 1450 inaugurated the dynastic and constitutional struggle that is romantically called the Wars of the Roses (York, the white rose; Lancaster, the red). In June 1460 the Yorkists triumphed, and Duke Richard was admitted heir to the throne, only to die at the Battle of Wakefield later in the same year. His son, however, became EDWARD IV (r. 1461-1470; 1471-1483), whose own sons, EDWARD V (r. 1483) and RICHARD PLANTAGENET (1472-1483), DUKE OF YORK, known as the princes in the Tower, were reputedly murdered on the orders of their uncle Richard III, the last Yorkist king. When Richard III was defeated and killed at the Battle of Bosworth Field in 1485, the throne passed to Henry VII, a Tudor, whose mother, Margaret Beaufort, was descended from John of Gaunt. By marrying Elizabeth, eldest daughter of the Yorkist Edward IV, Henry VII reconciled the conflicting claims of the descendants of Edward III. See also GREAT BRITAIN AND NORTHERN IRELAND, UNITED KINGDOM OF-21. *History* (Later Middle Ages): Wars of the Roses; ROSES, WARS OF THE.

Since the time of Edward IV, who created his younger son duke of York in 1474, the title has often been given to the second son of the English sovereign. By the deaths of elder brothers, three successive dukes of York became kings as Henry VIII, Charles I, and James II. George I in 1716 created his youngest and last surviving brother, ERNEST AUGUSTUS (1674-1728), duke of York and Albany; the Scottish title Albany, equivalent in importance to that of York, alluded tactfully to the union of the two crowns in 1707. EDWARD AUGUSTUS (1739-

1767), second son of Frederick Louis, prince of Wales, and FREDERICK AUGUSTUS (1763–1827; see YORK AND ALBANY, DUKE OF), second son of George III, also enjoyed this double title, receiving it in 1760 and 1784, respectively. Queen Victoria broke with tradition when she elected to confer the title Duke of Edinburgh on her second son, Prince Albert, but in 1892 she gave the title Duke of York to her grandson the future George V, second son of the prince of Wales (later Edward VII). George V's second son, the future George VI, became duke of York in 1920. Andrew, the second son of Queen Elizabeth II (daughter of George VI), was created duke of York on July 23, 1986.

WALLACE BROCKESY  
*Consultant to the Bollingen Foundation*

**YORK, Alvin Cullum** (1887–1964), American soldier. He was born in Pall Mall, Tenn., on Dec. 13, 1887. Although he requested exemption from active duty owing to his religious beliefs, he became a popular hero of World War I. As a corporal in Company G, 328th Infantry Regiment, 82d Division, he took part in the Argonne-Meuse offensive. On Oct. 8, 1918, near Châtel-Chéhéry, he crushed a German machine-gun battalion single-handedly, killing at least 25 and capturing 132 prisoners. York was made a sergeant and given more than 50 decorations and honors, including the Congressional Medal of Honor.

After the war York settled on a farm in Tennesse county given to him by the state of Tennessee. He requested the establishment of the York Foundation, which supported an industrial school and a Bible school. *Sergeant York: His Own Life Story and War Diary* was published in 1928; *Sergeant York*, a film based on his life, was made in 1941. York donated part of his royalties from the film to the York Foundation. He died in Nashville, Tenn., on Sept. 2, 1964.

**YORK**, city and county in North Yorkshire, England, on the Ouse River, about 200 miles (320 km) north of London and 22 miles (35 km) north-east of Leeds. It was the traditional county town of Yorkshire but was not included in any of the county's three "ridings," each of which had its own administrative center (see YORKSHIRE).

York is unique for its 14th-century walls and narrow medieval streets; the walls, 2.5 miles (4 km) in circumference, follow in part the line of Roman walls, whose remains can be seen. Two mounds, one walled, were erected by William I. St. Mary's Abbey Church and St. Leonard's Hospital (both in ruins) date from the 13th century; the Merchant Adventurers' Hall, from the 14th century; the Guildhall (gutted by bombs in 1942), St. Anthony's Hall, and the Merchant Taylors' Hall, all from the 15th century. Within the walls are York Minster (see YORK CATHEDRAL) and many other medieval churches. There are three notable museums: one of Roman York, another of medieval York, and the National Railway Museum. Modern York produces chocolate, cocoa, glassware, chemicals, scientific instruments, and machinery, and has important railway shops. Tourism is also an important industry. Both the University of York, founded in 1963, and the seat of the archbishop of York, Bishopthorpe, lie outside the city limits of York.

As Eboracum, York was the capital of Roman Britain. Under the Saxons it was the capital of

Northumbria and a noted seat of learning, where Alcuin was born and taught in the 8th century. Population: 123,126 (1981 census).

H. GORDON STOKES  
*Author of "English Place-Names"*

**YORK**, town, Maine, in York county, on the Atlantic Ocean, about 45 miles (72 km) southwest of Portland. It includes the summer resorts of York Harbor and York Beach. Chartered by Sir Ferdinando Gorges in 1642 as the city of Gorgeana, it was settled as Bristol plantation in 1638, changing its name to Agamenticus borough in 1641. In 1652 it passed under the control of Massachusetts and was reincorporated as York. Attacked by Native Americans, the settlement was almost wiped out in 1692. York has fine examples of colonial architecture; its jail, now the Old Gaol Museum, is the oldest English public building in North America that still stands and is open to the public. Population: 9,818.

**YORK**, city, Nebraska, seat of York county, 45 miles (72 km) west of Lincoln, on Beaver Creek, a branch of the Big Blue River. It lies in a rich prairie region and is a trading center for a wide farming and stock-raising area. A center of light industry including the manufacture of farm implements and mobile homes, York also has a robust transient-tourist trade. York College, a coeducational institution, was founded in 1890 and is controlled by the Church of Christ. York was founded by agents of the South Platte Land Company, platted in 1869, and incorporated in 1872. The neighboring settlement of New York was annexed in 1880. Population: 7,884.

**YORK**, city, seat of York county, Pennsylvania, 25 miles (40 km) by road south-southeast of Harrisburg, in the rich Pennsylvania Dutch farming region. York is the commercial center for one of the state's leading agricultural counties and an important producer of air-conditioning and refrigerating equipment, turbines, farm and construction machinery, wire cloth, roofing materials, and paper products. It is served by the Harrisburg International and York airports.

York has fine colonial homes and churches. The Friends' Meetinghouse, surrounded by the burial ground, has been in continuous use since the original part was built in 1765. York has a symphony orchestra and a history museum, and is the home of York College of Pennsylvania (coeducational), founded in 1941. The annual York Interstate Fair has long been a famous event in the area.

The city dates from 1741, when it was founded as a manorial town by the Penn family, most of the settlers being Germans, Scotch-Irish, and English Quakers. It was incorporated as a borough in 1787 and as a city in 1887. During the Revolutionary War the Continental Congress fled from British-occupied Philadelphia to York, where it met from Sept. 30, 1777, to June 27, 1778. During its sessions here the Articles of Confederation were adopted. Continental Square in present-day York marks the site of the colonial courthouse in which the Congress met. In 1863 the Confederates under Gen. Jubal Early took York, the largest community north of the Mason and Dixon Line to be occupied by Southern forces. Population: 42,192.

DANIEL R. PORTER  
*The Historical Society of York County*

**YORK, House of**, English royal house, a branch of the Plantagenet family, dating back to Edmund of Langley (1341-1402), who was created 1st duke of York in 1385. Richard Plantagenet (1411-1460), 3d duke of York, was head of the house; his sons Edward IV (r. 1461-1470; 1471-1483) and Richard III (r. 1483-1485) and his grandson Edward V (r. 1483) were kings of England. The house of York and the house of Lancaster contended for the English throne until they were united in 1486 by the marriage of Henry VII and Elizabeth, eldest daughter of Edward IV. See also GREAT BRITAIN AND NORTHERN IRELAND, UNITED KINGDOM OF-21. *History* (Later Middle Ages): Wars of the Roses; ROSES, WARS OF THE; YORK, DUKES OF.

**YORK AND ALBANY, DUKE OF** (FREDERICK AUGUSTUS), British general: b. London, England, Aug. 16, 1763; d. there, Jan. 5, 1827. Second son of George III of England, he was created duke of York and Albany in 1784, shortly after becoming a lieutenant general in the British Army. His career as a field commander from 1793 to 1795, when he had to contain the French in the Low Countries, included a brilliant victory at Beaumont (1794), but in general he failed because his allies were unreliable. He was commander in chief in Great Britain and Ireland from 1801 until his death, except for two years: he resigned in 1809 after it was proved that his mistress, Mary Anne Clarke, had taken bribes to influence him to promote certain officers, but his own integrity was not questioned, and he was reinstated in 1811. In conducting the home defense he redeemed whatever errors he had made in the field. By 1814 he had created an army that was second to none, and competent authorities have pronounced him the ablest administrator in the history of the British Army.

WALLACE BROCKWAY.

**YORK CATHEDRAL** (known as YORK MINSTER), the Cathedral Church of St. Peter, England's largest medieval cathedral, in York. A wooden building, erected for the baptism of Edwin, king of Northumbria, on Easter Day 627, was followed by three other structures before the present one was begun in 1220. The octagonal chapter house was completed in 1330, the unusually wide and lofty nave in 1345, the choir in 1405, and the massive central tower in 1430. The stately twin

towers were added between 1433 and 1473. York Minster has a magnificent 14th century English Gothic front and is famous for the finest display of medieval colored glass in England, especially the great 15th century east window and the striking 13th century "Five Sisters" in the north transept.

H. GORDON STOKES.

**YORKSHIRE**, yôrk'shîr, county, England, in the northern part of the country, extending west from the North Sea to within a few miles of the Irish Sea, and southward from County Durham and Westmorland to Derbyshire, Nottinghamshire, and Lincolnshire. England's largest county (6,091 square miles), it is divided for administrative purposes into three "ridings" (thirdings), North, East, and West, of which the last is the largest and includes the main industrial area. The ridings meet near the city of York, which is, however, not in a riding but in the small district of Ainsty. York is the traditional county town, but each of the ridings has its own administrative headquarters: Beverley (East Riding); Northallerton (North Riding); Wakefield (West Riding).

The western boundaries of Yorkshire lie along the flank of the Pennine Chain; Mickel Fell (2,591 feet) is the highest point. North and northeast are the Cleveland and Hambleton Hills and the extensive Yorkshire Moors. The central part of the east coast comprises high chalk cliffs, which fall away north from Whitby to the mouth of the Tees River, and south from Flamborough to Spurn Head, along a shore much subject to erosion. Curving south and southwest from Flamborough is the chalk upland of the Yorkshire Wolds.

The river Ribble flows west to the Irish Sea; all others flow east or southeast to converge on the wide estuary known as the Humber, where Goole is a busy transshipment point between the inland waterways and the important seaport of Hull. Sheep are bred on the higher ground; elsewhere oats, barley, wheat, and sugar beet are grown, and there is stockraising and milk production.

The dales, in the west, contain some of England's most beautiful medieval abbeys: Fountains, Bolton, and Rievaulx. Scarborough, Bridlington, Filey, Whitby, Saltburn, and Redcar are popular resorts on the east coast; Harrogate, 20

Medieval abbeys and old towns like Malham are tourist attractions in Yorkshire.

British Travel Association





miles west of York, is a well-known spa.

Leeds is the most important industrial city, with a wide range of industries but basically a textile town, like Bradford, Halifax, and Huddersfield, born of the former abundance of local wool and the availability of water. Coal and metallurgical industries predominate in southern towns like Doncaster, Rotherham, and above all Sheffield. Middlesbrough, in the north, was founded on the hematite ore formerly abundant in the Cleveland Hills, but most of the ore for the county's industries is now imported. Population: (1961) 4,725,976.

H. GORDON STOKES,  
*Author of "English Place-Names."*

**YORKSHIRE TERRIER**, a long-coated toy terrier, introduced into the United States about 1880 and first recognized by the Kennel Club in England in 1886. It is closely related to the Skye terrier, perhaps with infusions of the old black-and-tan terrier. The breed has a compact body, short legs, upright carriage, and a distinctive straight silky coat sometimes reaching the ground. The head is small and flat, ears are V-shaped, semi-erect or erect, the body color a dark steel blue, with golden tan on head and chest but not intermingled. With a typical terrier temperament, the dog displays an air of importance and is a fashionable, if not an ancient, breed.

WILLIAM F. BROWN.

**YORKTON**, yòrk'tən, city, Saskatchewan, Canada, 100 miles northeast of Regina. It is served by the Canadian Pacific and Canadian National railways and has an airport. The city is the business, cultural, and wholesale distributing center for a large and well-settled agricultural area. Industries include flour milling, a slaughterhouse, an oil refinery, and printing plants. Turkey raising is a profitable commercial pursuit. There are many attractive lake resorts in the area. Yorkton was founded in 1882 by the York Farmers' Colonization Company, from York County, Ontario; the original townsite was to the northeast, on Yorkton Creek. It was incorporated as a village in 1894, as a town in 1900, and as a city in 1928. Population: 15,339.

JOHN H. ARCHER.

**YORKTOWN**, yòrk'toun, town, Virginia, seat of York County, on the York River, near its mouth on Chesapeake Bay, 11 miles east-southeast of Williamsburg. Portions of the town are included in the Colonial National Historical Park. It was settled as early as 1631, established as a county port in 1691, and the county seat was moved here in 1698. Yorktown was a thriving commercial port until the American Revolution, and the last decisive battle of the war was fought here, ending with the surrender of Gen. Charles Cornwallis on Oct. 19, 1781 (see **YORKTOWN, CAMPAIGN AND SIEGE OF**). Historic landmarks include the Moore House, where the articles of capitulation between Cornwallis and George Washington were negotiated; the Custom House (1706; restored 1929); Grace Church (1697); and the Nelson House, home of Thomas Nelson (q.v.). The elaborate white marble Yorktown Victory Monument, a 95-foot shaft overlooking the York River, commemorating the Revolutionary victory, was authorized by Congress in 1781. In the Civil War, Yorktown was captured (1862) by Gen. George B. McClellan on his drive toward Richmond.

**YORKTOWN, Campaign and Siege of**, in the American Revolution. On May 22, 1781, when the fate of the American Revolution seemed darkest, Gen. George Washington received word that a French fleet, with troop reinforcements, guns, and supplies, was en route from France to assist him. Adm. Comte Louis de Barras, with part of the fleet, soon arrived at Newport, R.I., the base of French forces in the United States. Early in July the comte de Rochambeau moved his 4,800 French troops from Newport to join Washington's 4,500 in the Hudson Valley. The futility of attacking Gen. Sir Henry Clinton's 17,000 strongly entrenched troops in New York City was apparent, and Washington's eyes turned to the south.

His decision was made for him with the arrival of a message from Adm. Comte François de Grasse, announcing that the remainder of the French Fleet, with 3,000 troops aboard, would leave the West Indies in mid-August for Chesapeake Bay, where it could remain only until mid-October.

Meanwhile Gen. Charles Cornwallis (2d Earl Cornwallis), British commander in the south, had fortified Yorktown, Va., to control the entrance to the York River. Washington quickly ordered the marquis de Lafayette, in Virginia, to block the Yorktown peninsula to prevent the escape of Cornwallis, and gathered his forces for a rapid movement southward. Gen. William Heath, with 2,500 men, was left at West Point, N.Y., to guard the Hudson Valley against Clinton. This was a hazardous venture, since Clinton could easily overwhelm Heath and separate New England from the other colonies. But an American victory was essential to bolster the disheartened patriots, and Washington accepted the risks for the sake of the potential gains.

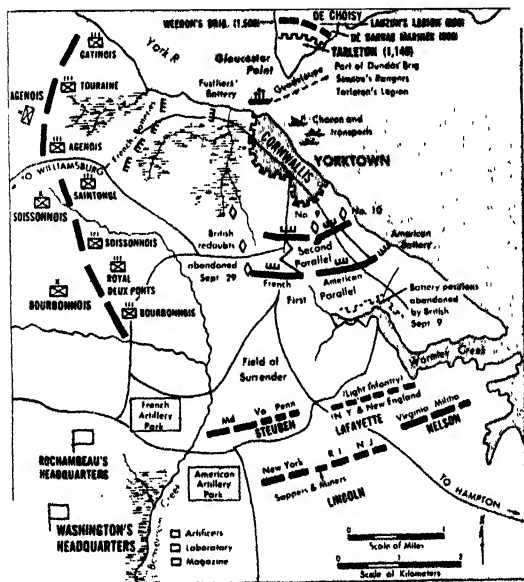
The movement southward was conducted so as to reinforce Clinton's belief that an attack on New York City was contemplated. It was not until Washington's troops had reached Trenton, N.J., that Clinton discerned the true purpose of the march. Immediately he began to organize an expedition to send to the aid of Cornwallis. The combined British fleets of Adm. Sir Thomas Graves and Adm. Sir Samuel Hood were rushed to intercept de Grasse. However, de Grasse reached Chesapeake Bay safely and repulsed the British in a stiff battle. When de Barras with his fleet from Newport joined de Grasse, the British ships fled back to New York.

Washington's leading troops reached Elkton, Md., at the head of Chesapeake Bay, on September 6. On the 18th his army sailed in de Grasse's transports from Elkton, Annapolis, and Baltimore. By the 26th it had joined Lafayette on the Yorktown peninsula in Virginia. Cornwallis had strongly entrenched the land side of Yorktown, augmenting his line with 6 batteries and 7 redoubts. Heavy batteries commanded the sea side of the town, and the British frigates *Guadeloupe* and *Charon*, with several transports, lay off the coast.

Across the river, a detachment had entrenched Gloucester Point, Va. In addition, Cornwallis had constructed an outer line of redoubts and batteries. When he learned that Clinton was sending relief, he abandoned most of these, believing that he could make a stronger defense for the short time necessary with his forces concentrated at Yorktown.

Washington's troops took positions as shown

on the accompanying sketch. Detachments occupied the abandoned enemy works, and artillery was started from Williamsburg, Va., toward the front. On October 6, under heavy British gunfire, the digging of the first parallel, 600 yards from the British lines, was begun; the Americans worked on the eastern portion, and the French on the western. That night troops of the French Régiment Touraine attacked the Fusiliers' Redoubt but were repulsed. On the 9th the French battery (10 guns) on the coast opened fire and drove the *Guadeloupe* away. On that day also Washington personally fired the first shot from the American battery (12 guns) on the coast. The next day a French battery (12 guns) and an American battery (6 guns), positioned at the parallel, joined in the bombardment. French red-hot shot set the *Charon* and two transports afire, causing their destruction. On the night of the 11th, Baron Friedrich Wilhelm von Steuben's division began construction of the second parallel, only 300 yards from the British defenses. Before this parallel could be extended to the east, British redoubts nos. 9 and 10 had to be reduced. On the 14th a detachment from the Gâtinois and Royal Deux-Ponts regiments, under Col. Guillaume de Deux-Ponts, stormed and captured Redoubt No. 9 in heavy fighting. Simultaneously, an American detachment of New York and New England light infantry troops, under Lt. Col. Alexander Hamilton, charged Redoubt No. 10 with the bayonet and carried it quickly. The second parallel was then extended to include the two captured redoubts.



A British sortie on October 16, by a detachment under Lt. Col. Robert Abercrombie, succeeded in disabling 7 guns of a French and an American battery on the second parallel, but the British were driven back and the guns quickly put in order. Cornwallis then sought to save his army by a movement across the river to Gloucester Point, where he could overwhelm the marquis de Choisy's small force and thence march to New York to join Clinton. By midnight most of the Guards and some other troops were set ashore at Gloucester Point, but a sudden

storm broke, driving the boats upstream. The boats, with the troops that they had carried to Gloucester, returned the next day, but too late. That morning all of the Allied artillery opened a furious cannonade, shattering the British defenses and silencing their artillery. His lines ripe for an Allied assault, Cornwallis offered to capitulate. The surrender, which closed what proved to be the decisive battle of the entire war, was completed on October 19, the same day the British relief expedition sailed from New York.

Cornwallis surrendered 7,157 troops (including sick and wounded not engaged) and 840 sailors, together with 244 artillery pieces. Losses on both sides were light: British and Hessian, 156 killed and 326 wounded; French, 52 killed and 134 wounded; American, 20 killed and 56 wounded.

VINCENT J. ESPOSITO,  
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#### FORCES ENGAGED AT YORKTOWN

##### American (8,845 men)

**Infantry.**—Gen. Benjamin Lincoln's Continental division (1,725): Gen. James Clinton's brigade (1st and 2d New York regiments) and Col. Elias Dayton's brigade (1st and 2d New Jersey regiments and the Rhode Island Regiment).

Baron von Steuben's division (1,900): Gen. Anthony Wayne's brigade (1st and 2d Pennsylvania battalions and 1 Virginia battalion) and Gen. Mordecai Gist's brigade (3d and 4th Maryland regiments).

Marquis de Lafayette's light infantry division (1,500), principally troops from New York and the New England states: Gen. Peter Muhlenberg's brigade and Gen. Moses Hazen's brigade (including Hazen's Canadian Regiment).

Gen. Thomas Nelson's Virginia Militia (3,200): the brigades of Gen. Robert Lawson, Gen. Edward Stevens, and Gen. George Weedon, and Lt. Col. Charles Dabney's Virginia State Regiment.

**Artillery.**—Col. John Lamb's 2d Continental Artillery Regiment and two companies of the 1st and 5th regiments (310).

**Cavalry.**—Col. Stephen Moylan's 4th Dragoons and Col. Charles Armand's Legion (100).  
**Sappers and Miners.**—(110).

##### French (7,800 men)

**Infantry.**—General de Saint-Simon's Brigade Agénais (3,000): Colonel d'Authamp's Régiment Agénais, Colonel de Rastain's Régiment Gâtinois, and Colonel de Pondeaux's Régiment Touraine.

Vicomte de Viomenil's Brigade Soissonnais (1,800): Colonel de Saint-Maime's Régiment Soissonnais and Colonel de Custine's Régiment Saintonge.

Baron de Viomenil's Brigade Bourbonnais (1,800): Colonel de Laval's Régiment Bourbonnais and Colonel des Deux-Ponts's Régiment Royal Deux-Ponts.

**Cavalry.**—Duc de Lauzun's Légion (600).  
**Artillery.**—(600).

##### British (5,965 men)

**Infantry.**—Gen. Charles O'Hara's Guards brigade (467); Lt. Col. Robert Abercrombie's light infantry (600); Col. John Yorke's infantry brigade (900: 17th, 23d, 33d, and 71st regiments); Col. Thomas Dundas's infantry brigade (1,500: 43d, 76th, and 80th regiments); Colonel von Voigt's and Colonel von Seybothen's Ansbach regiments (950); Hessian regiments Prince Héritaire and von Bose (700); Jäger detachment (68); and Lt. Col. John Hamilton's North Carolina Tories (114).

**Cavalry.**—Col. John G. Simcoe's Queen's Rangers and Col. Banastre Tarleton's British Legion (440).  
**Royal Artillery.**—(193)  
**Pioneers.**—(33).

**YORKVILLE**, yôrk'vîl, a section of New York City in the Borough of Manhattan. It was founded as a village within the city about 1790 in the area south of Harlem from the old Boston Post Road (Third Avenue) to the East River between 79th and 90th streets, and later expanded to include the district bounded by what is now Lexington Avenue and the river between 59th and 96th streets. Yorkville was successively a farming village, an area of fine country estates of wealthy New Yorkers, and a commuting center after 1834, when the New York and Harlem Railroad connected with Prince Street. Later the section became known as a foreign quarter, first German and Irish, and then central European. Points of interest include Gracie Mansion, the residence of the Mayor of New York City, built about 1794 and situated in Carl Schurz Park; the New York Hospital and Cornell University Medical College; and the Rockefeller Institute for Medical Research and Memorial Sloan-Kettering Cancer Center.

**YORUBA**, yôr'ə-bə, the third largest ethnic group in Nigeria, Africa's most populous nation. About 10,000,000 Yoruba live in Nigeria's Western Region; over 500,000 are in the Northern Region, and there are about 200,000 in Dahomey and Togo, and in eastern Nigeria.

The Yoruba share a common language and cultural base, but were divided politically into independent kingdoms which warred among themselves and with the neighboring Dahomeans and Fulani throughout the 19th century. The slave wars carried large numbers to Brazil and Cuba, where the Yoruba language is still spoken and Yoruba deities are still worshipped.

The economy of the Yoruba is founded on hoe agriculture, trading, and handicrafts. Maize and manioc, introduced by the early Portuguese, and yams are the staple crops. During the 20th century cacao became an important cash crop. It is now Nigeria's most valuable export, and the Yoruba produce over 90 percent of it. Until sterling currency was introduced, cowrie shells were used as money. Women traders buy local produce and resell it for a profit in the large markets, while men formerly controlled trade with neighboring towns.

Even before contact with Europeans, the Yoruba grew cotton and wove cloth, smelted iron and practiced smithery, cast bronze—using the lost-wax (cire-perdue) process—and made glass. Glassmaking and iron smelting are no longer practiced. They dye and appliqué leather, do beadworking and embroidery, and carve wood, bone, ivory, and calabashes; they also formerly carved stone. All these crafts, except weaving, which is practiced by both sexes, are the work of men; women do spinning, dyeing and tie-dyeing, basketry and matting, and make pottery. The Yoruba produced the greatest wealth of art of any African people, and the ancient bronze castings found at the Yoruba city of Ife rank among the art masterpieces of the world.

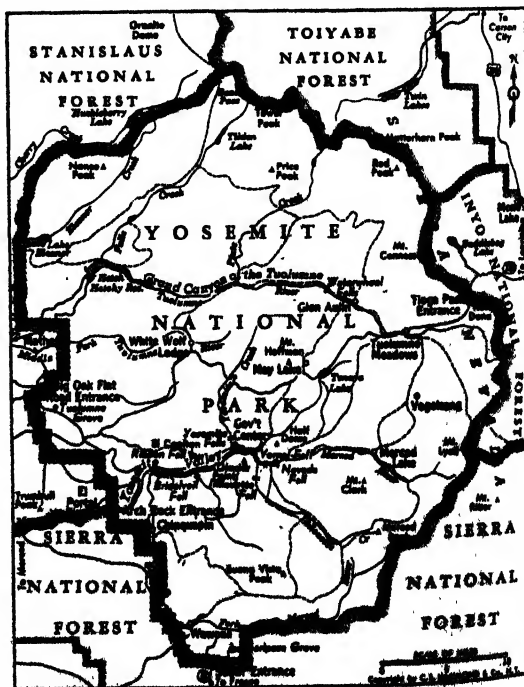
The Yoruba tradition of urbanism antedates European contact, and they are the most urban of African peoples. Nearly a third (31 percent) live in 12 communities of over 40,000 in population, while 22 percent live in 6 cities of over 100,000, of which Ibadan, with over 600,000 people, is the largest.

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**YOSEMITE NATIONAL PARK**, yô-sēm'ə-tě, national park, California, embracing a spectacular mountain region about 150 miles east of San Francisco, on the western slope of the central Sierra Nevada. The park comprises 760,951 acres (1,189 square miles) surrounding the headwaters of the Merced and Tuolumne rivers from the Sierran crest on the east to the foothills of the Mother Lode country on the west. Although the park contains much beautiful scenery in the High Sierra, it was created primarily to preserve the magnificent Yosemite Valley and the Mariposa Grove of rare "Big Trees" (*Sequoia gigantea*).

**Scenic Features.** Yosemite Valley, called Ahwahnee (deep grassy valley) by the Indians, is a flat-floored, glacially gouged valley about 7 miles long and less than 1 mile wide. On its floor (elevation 3,960 feet) the Merced River meanders placidly through meadows and groves of trees. On either side magnificent granite walls rise almost perpendicularly 2,500 to 3,500 feet from the valley's edge. The promontories and abutments created by glacial and stream erosion and the waterfalls formed when their lower courses were truncated are among the world's best-known scenic wonders. Yosemite Falls, on the north side of the valley behind Yosemite Village, drops 2,610 feet in three stages and is the longest falls in North America; Bridalveil Falls on the south side near the lower entrance to the valley has a sheer drop of 620 feet over a granite cliff. Dominating the lower end of the valley on its north side is El Capitan (7,564 feet), and farther upstream are the Three Brothers (6,860 feet), Yosemite Point (6,935 feet), and the North Dome (7,531 feet) rising high above the Royal Arches. On the south side, Old Inspiration Point (6,603 feet), Cathedral Rocks (6,638 feet), and Glacier Point (7,214 feet) are the dominant features. At the eastern end of the valley between Tenaya

Yosemite National Park





El Capitan and Bridalveil Falls frame the lower end of the 7-mile-long glacially gouged Yosemite Valley.

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Creek and the Merced River is the monumental Half Dome (8,852 feet), its flat northern face formed during an earlier stage of erosion.

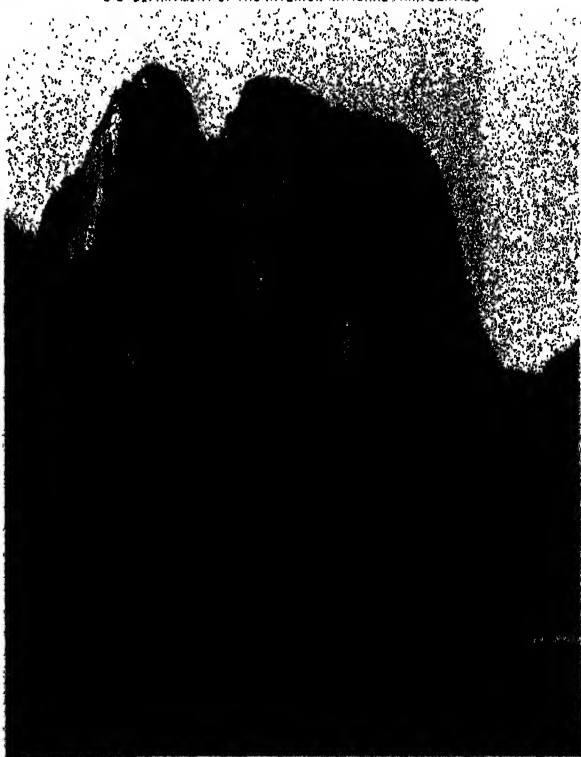
The floor of the valley contains no sequoia trees, since the climate is not suitable, but there are three groves in the high country within the park. The Mariposa Grove, 36 miles south of Yosemite Village, is the largest, with about 200 mature trees, and the most frequently visited, although the Tuolumne Grove and the Merced Grove are both accessible by road north of the valley. Many of the giant sequoia have attained a height of 250 feet, a girth of 30 feet, and an age of 3,500 years, but their size and age have been stressed to the detriment of their superb form.

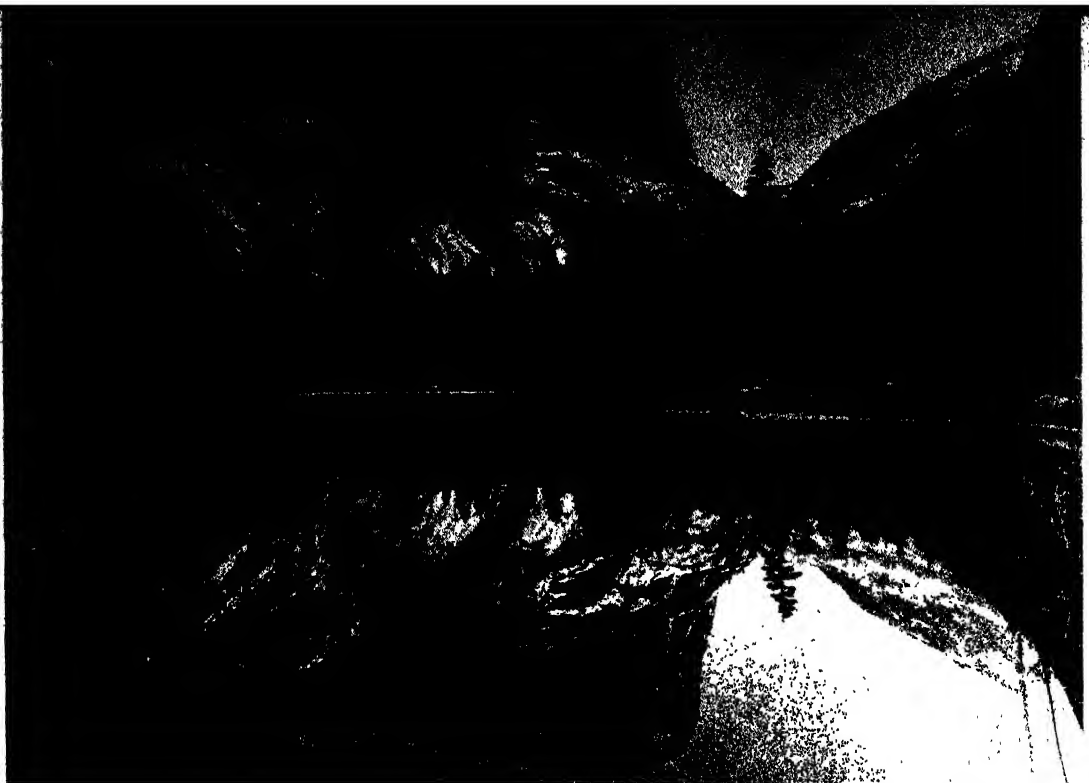
**Geology.** Prior to the last glacial age, which ended some 10,000 years ago, the Merced River and its tributaries had cut deep narrow canyons into the granite of which the Sierras are formed. Above the gently rolling lands between the canyons there were numerous "domes" of bare granite almost hemispheric in shape. Glaciers flowed down the canyons of both the Merced and the Tenaya, its main tributary, joining just west of Half Dome. The enlarged river of ice, estimated to have been more than 3,000 feet thick, deepened the lower canyon about 1,200 feet, widened it in the characteristic U shape by 3,500 feet, and created the almost vertical walls present today. The terminal moraine at the end of the glacier's advance formed a dam and created a long narrow lake about 300 feet deep. The lake gradually filled as rock fragments were washed in by the rivers and streams, leaving the almost level lake plain over which the Merced River meanders.

**History.** Yosemite Valley was not discovered until 1851 when Maj. James D. Savage, leading

Cathedral Rocks, on the southern side of the valley, rise to heights of more than 6,600 feet.

U. S. DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE

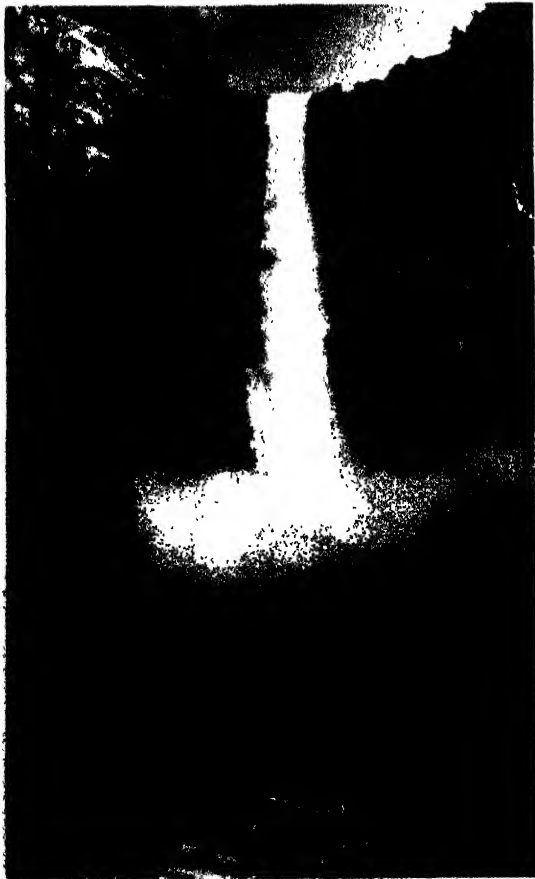




KENNETH C. POETNER

(Above) Mirror Lake reflects in its placid surface the image of 4,400-foot Mount Watkins. (Below) Bridalveil Falls plunges 620 feet over a granite cliff.

AL LOWRY, FROM PHOTO RESEARCHERS



the Mariposa Battalion in pursuit of a band of Indians who had been raiding mining camps in the Mother Lode, traced them to the valley, which was their home. The Indians were of the Miwok tribe but were called the Yosemite (Miwok for "grizzly bear") after their clan totem; and Lafayette H. Bunnell, who accompanied the battalion, suggested that the euphonious name of the clan be given to the valley. The Yosemite were the most warlike clan of the Miwok, and perhaps for that reason they were able to keep the valley for themselves. In the Indian pattern of living, this was a rich area, far better than the high country on either side. The main portion of the diet was acorns, which grew in profusion on the oaks of the valley floor; in addition, there was a variety of game animals, fish, grass seeds, and other vegetable foods. Although there was much snow in the winter in the surrounding high country, the climate of the valley floor was not too severe. There were about 22 Indian villages in the valley when it was discovered.

As early as 1855 visitors began to arrive in the valley, and their descriptions of its magnificence attracted an increasing number of tourists despite the rugged trip. To preserve the beauties of Yosemite, Congress in 1864 made a special grant of 48.6 square miles of the area to California for a state park, including not only the valley but also the Mariposa Grove. In 1890 the Yosemite National Park was established surrounding the state park. Separate administrations caused difficulty, and in 1906 the state ceded its park back to federal control. Although, since its beginning, control of the national park has been vested in the secretary of the interior, the United States Army operated it until 1916, when the National Park Service was created.

**Facilities.** For many years the only access to the park was by horseback or stagecoach descending over steep trails or poor roads from the north and south. Then, in 1926 a road was con-



structed up the steep and narrow Merced Canyon below the valley, and there are now three good automobile highways. A magnificent set of trails has been constructed by the National Park Service, making the back country to the east, north, and south accessible to hikers and pack trains.

Numerous camping sites have been provided in the valley itself and along the trails in the high country, and there is a fine museum in Yosemite Village. In addition, facilities ranging from housekeeping cabins to excellent hotels are available. Many of these facilities are open on a year-round basis to provide for winter sports.

JOHN W. REITH

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**YOSHIDA**, yō-shē-dā, **Shigeru**, Japanese statesman: b. Tokyo, Japan, Sept. 22, 1878; d. Oishi, Japan, Oct. 20, 1967. He was the son of Tsuna Takeuchi, but he was adopted by Kenzo Yoshida and married the daughter of the statesman Count Nobuaki Makino. After graduating from Tokyo Imperial University in 1906, Yoshida promptly entered the foreign service. During the period when Japan was establishing hegemony in Manchuria, he held the key positions of consul general in Tientsin (1922-1925) and Mukden (1925-1928) and vice foreign minister (1928-1930) in the cabinet of Gi ichi Tanaka and his successor. His last official position before World War II was ambassador to Britain (1936-1939).

Despite his close ties with the bureaucracy, the *zaibatsu* (financial cliques), and court circles, Yoshida was imprisoned (June-August 1945) for activities against the former prime minister, Hideki Tojo, in favor of peace. After Japan's surrender, he was appointed foreign minister in the cabinets of Naruhiko Higashikuni (1945) and Kijuro Shidehara (1946). When Ichiro Hatoyama was purged from politics by the American occupation authorities, Yoshida became leader of the Liberal Party and formed his first cabinet in 1946. From 1948 to 1954 he served continuously as prime minister, a record in Japanese history. With the support of the occupation authorities he exercised near-dictatorial powers to adopt the new Constitution (1947), to effect land reform, to sign the peace treaty at San Francisco (Sept. 8, 1951), and to negotiate the first mutual security pact with the United States.

ARDATH W. BURKS

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**YOSHIMASA**, yō-shē-mā-sā (in full YOSHIMASA ASHIKAGA), Japanese shogun: b. 1436; d. 1490. He was the grandson of Yoshimitsu and 8th in the line of Ashikaga shoguns. His rule (1443-1473) was marred by a deterioration of shogunal authority, general economic distress, and lengthy civil war. Yoshimasa himself was more inclined to aesthetic pastimes than to the affairs of government. He is said to have permitted the issuance of 13 debt cancellation (*tokusei*) edicts in an effort to ameliorate the financial distress of the military class. Such measures only served to throw commercial activities into confusion and did little to stem the tide of city riots and peasant uprisings. Yoshimasa's choice of heir precipitated the destructive Onin War (1467-1477), which was fought in the streets and environs of Kyoto, the capital city. Meanwhile he retired to

his newly built Silver Pavilion (Ginkaku) in the eastern hills (Higashiyama) of Kyoto, where he patronized a coterie of artists, actors, and Zen priests. This group is credited with advancing the art forms of the tea ceremony and *no* (Jap. *nō*) drama and setting Japanese taste in ceramics, painting, and architecture for many centuries to come, in what is called the Higashiyama period of artistic development.

JOHN W. HALL, *Yale University*

**YOSHIMITSU**, yō-shē-mē-tsōō (in full YOSHIMITSU ASHIKAGA), Japanese shogun: b. 1358; d. 1408. He was the 3d shogun in the Ashikaga line, which reached its zenith under his shogunate (1367-1395). With the aid of his deputy, Yoriyuki Hosokawa, Yoshimitsu forced his most turbulent vassals, the Yamana and Ouchi, into submission and brought an end (1392) to the civil war that had raged throughout the country in the name of the rivalry between the north and south imperial courts. Having established his seat of authority at Muromachi in Kyoto, Yoshimitsu ruled with great pomp, taking the highest of court titles and even aspiring to imperial status. Under him the administrative structure of the Ashikaga shogunate took its final shape. Yoshimitsu retired from office in 1395 but continued to direct Ashikaga policy. In 1397 he built the famous Golden Pavilion (Kinkaku), a villa on the outskirts of Kyoto, at which he entertained.

**YOSHIMUNE**, yō-shē-mōō-nē (in full YOSHIMUNE TOKUGAWA), Japanese shogun: b. 1684; d. 1751. Eighth of the Tokugawa line, he was the third son of Mitsusada Tokugawa, daimyo of Kii. Yoshimune became lord of Kii in 1705 but was called to succeed to the main Tokugawa line in 1716 and continued to hold the shogunate until his retirement in 1745. He was one of the few shoguns after Ieyasu, founder of the Tokugawa line, to exercise personal influence on shogunal policy. Faced by financial weakness in the shogunate and general economic deterioration of the warrior class, he conducted a vigorous reform of government and fiscal policy, known as the Kyōko reform. Yoshimune reduced shogunal expenditures and reissued the country's gold currency, reversing the debasement policy of his predecessors. Though conservative in his domestic policies, in 1720 he lifted the ban on the importation of Western books in order to bring in technical knowledge. He ordered a revision of the calendar and encouraged land reclamation, the spread of sericulture, and the cultivation of such new crops as the sweet potato. Yoshimune's policies were a momentary success, but in the main they affected the symptoms and not the root of the problems faced by the Tokugawa government.

JOHN W. HALL, *Yale University*

**YOSHITSUNE**, yō-shē-tsōō-nē (in full YOSHITSUNE MINAMOTO), Japanese warrior: b. 1159; d. 1189. The son of Yoshitomo and younger half-brother of Yoritomo, he was exiled to a monastery after the victory of the Taira clan over his own in 1160. In 1180, on hearing that Yoritomo had begun an attack on the Taira, Yoshitsune raised a following, joined other members of his clan, and quickly distinguished himself for his gallantry and bold strategy. He is best known for brilliant victories over members of the Taira clan at Ichino-tani, Yashima, and Dan-no-ura (1185). Re-

turning in triumph to the capital, he received favors from ex-emperor Go-Shirakawa and thereby incurred the mistrust of Yoritomo. Eventually he was frustrated in an attack on Yoritomo and spent the last years of his life as a fugitive from Yoritomo's agents. Tracked down at Hiraizumi in northern Honshu, he committed suicide to avoid capture. Many episodes of his life have been depicted in ballads and classical drama.

JOHN W. HALL.

**YOST, yöst, Fielding Harris**, American football coach: b. Fairview, W.Va., April 30, 1871; d. Ann Arbor, Mich., Aug. 20, 1946. After taking a law degree (1897) at the University of West Virginia, he became head football coach at the University of Michigan (1901-1927). Known as "Hurry Up" Yost, he coached Michigan's famous "point-a-minute" football teams (1901-1905) and devised outstanding blocking and signaling systems. As director of athletics at Michigan from 1921 to 1941, he developed the university's athletic facilities and intramural sports program to meet his ideal of "sports for all." He wrote *Football for Player and Spectator* (1905).

**YOU CAN'T GO HOME AGAIN**, a novel by Thomas Wolfe that was published posthumously in 1940. It is a continuation of *The Web and the Rock* (1939; see WEB AND THE ROCK, THE); together they constitute the second of Wolfe's immensely long fictional autobiographies, the first comprising *Look Homeward, Angel* (1929) and *Of Time and the River* (1935). The hero of the earlier volumes, Eugene Gant, becomes George Webber; either way he is a dramatic projection of Wolfe himself, who was incapable of real objectivity in his novels.

In *You Can't Go Home Again* Wolfe voices his surprise and disappointment at the hostile reception of his first novel in his home town. His isolation is increased when he breaks off his love affair with Esther Jack and takes to writing almost uninterruptedly in a Brooklyn tenement. He is dependent upon his editor and friend Foxhall Edwards (a transparent disguise for Maxwell E. Perkins of Scribner's), whom he later rejects to assert his independence as a writer. In England he meets Lloyd McHarg (actually Sinclair Lewis), and in Germany he enjoys fame and fortune; but he returns to America despondent about the future as war clouds gather over Europe. This novel, Wolfe's last, stands firmly on a level with his other three major works.

DELANCEY FERGUSON.

**YOUNG, Vincent**, American composer of light music: b. New York, N.Y., Sept. 27, 1898; d. Denver, Colo., April 5, 1946. Although he showed prodigious musical talent as a child and was given serious training, he at first meant to become an engineer and then worked briefly in Wall Street. While in the United States Navy during World War I, he was in the entertainment unit at Great Lakes Naval Training Station. In 1918 he joined a New York publisher of popular sheet music. His first musical comedy, *Two Little Girls in Blue* (with lyrics by Ira Gershwin) was staged in New York in 1921; it was followed, among others, by *Wildflower* (1923), *No, No, Nanette* (1924), *Oh, Please* (1926), *Hit the Deck* (1927), and *Great Day* (1929), some of them composed with others. He also wrote the hit score for the motion picture *Flying Down to Rio*

(1933); shortly thereafter he was incapacitated by tuberculosis, from which he died after necessarily idle years spent in New Orleans and Denver. A number of his songs remain in the permanent repertoire, among them *Bambalina*, *The Carioca*, *Great Day*, *Hallelujah*, *I Want to Be Happy*, *Rise 'n' Shine*, *Sometimes I'm Happy*, *Tea for Two*, *Time on My Hands*, and *Without a Song*.

HERBERT WEINSTOCK.

**YOUNG, Andrew** (1932- ), American public official and former ambassador to the United Nations. Andrew Jackson Young, Jr., was born in New Orleans, La., on March 12, 1932. Intending to become a dentist, like his father, he attended Howard University (B.S., 1951) but then decided to enter the ministry and went on to Hartford (Conn.) Theological Seminary (B.D., 1955). He was ordained in the United Church of Christ and held pastorships in Alabama and Georgia.

While he was working with a voter registration project for the United Church of Christ, he collaborated with Dr. Martin Luther King, Jr. Subsequently he joined the Southern Christian Leadership Conference (SCLC), becoming executive director in 1964 and, after Dr. King's death, executive vice president under the Rev. Ralph Abernathy. He was active also in antisegregation campaigns in Birmingham, Ala., and Chicago and in the 1968 antipoverty march in Washington, D.C.

In 1970, Young ran unsuccessfully for Congress in Georgia's 5th district, but he won in a second try in 1972 and was reelected in 1974 and 1976. An adviser to Jimmy Carter during Carter's 1970 bid for the Georgia governorship and again during the 1976 presidential campaign, Young was named ambassador to the United Nations by Carter in December 1976 and was sworn in on Jan. 30, 1977.

Young's assignments as ambassador included fact-finding missions to Africa and tours of Caribbean and Latin American countries. He aroused criticism because of his frank and often caustic expressions of opinion, and occasionally his statements were repudiated by the State Department. On Aug. 16, 1979, after an unauthorized meeting with a Palestine Liberation Organization representative, he resigned his UN post. He was elected mayor of Atlanta in 1981 and reelected in 1985. Barred by law from seeking a third term as mayor, he ran for the governorship of Georgia in 1990 but was defeated in a runoff election for the Democratic nomination.

**YOUNG, yung, Arthur**, English agricultural writer: b. London, England, Sept. 11, 1741, d. there, April 20, 1820. "His family were gentry from Bradfield Combust, Suffolk, where he spent much of his life. He was intended for a mercantile career and also tried journalism for a time, but in 1763 he became a farmer and practiced agriculture for the remainder of his life.

Although never financially successful as a farmer, Young became the outstanding publicist for the agricultural revolution. He first gained recognition through the nine volumes on his three agricultural tours of England, which he made from 1768 to 1771. The *Tour in Ireland* appeared in 1780. His *French Travels During the Years 1787, 1788, and 1789* (1792) was his most famous work and still remains a valuable primary source for the background of the French

Revolution. Young was primarily interested in crops, livestock, and agricultural methods and improvements, but he also described agrarian classes, tenures, roads, inns, trade, and manufactures. At its best, his journalistic style was sprightly and vivid. Some of his books were translated into French, Russian, and German, and he carried on a wide correspondence with famous people, including George Washington and the marquis de Lafayette.

In 1784 he began the periodical, *Annals of Agriculture*, which appeared continuously until 1809 and ran to volumes, of which he wrote about a third. Among his contributors was George III, who wrote under the name of Ralph Robinson, his Windsor shepherd. In 1793 Young was appointed secretary to the newly created Board of Agriculture, a post he held until his death. He also served actively for many years in the Society of Arts.

Although Young himself contributed little to scientific agriculture, he was always its inspired publicist, explaining and supporting such advances as the seed drill and horse hoe, improved crop rotations using root crops to eliminate fallows, and better stockbreeding methods. As spokesman for the nobility and gentry, he backed the corn laws, attacked tithes and poor rates, and supported enclosures until very late in his life. His early writings were strongly mercantilist, but later he favored some laissez-faire doctrines. Until 1792 he was fairly liberal, but the excesses of the French Revolution made him very conservative, as is shown in *The Example of France a Warning to Britain* (1793). Following the death of his favorite daughter in 1797, Young experienced a deep religious conversion and became a fervent Evangelical. He was blind in his last years.

JOHN G. GAZLEY  
Professor of History  
Dartmouth College

**YOUNG, Brigham**, Mormon leader: b. Whitingham, Vt., June 1, 1801; d. Salt Lake City, Utah, Aug. 29, 1877. He was the ninth of 11 children of John and Abigail (Howe) Young. When he was three years old, his indigent family moved to a region of upstate New York called the "burnt-over district" for its excesses of religious enthusiasm. Brigham grew up, practically without formal education, to become a journeyman painter and glazier. In 1829, he moved to Mendon, New York, and in 1832, after pondering the *Book of Mormon* for two years, he left the Methodists, whom he had joined at the age of 22. He followed several members of his family into the Mormon Church, in whose ranks he steadily rose to importance.

Young was appointed an apostle in the Mormon Church in 1835 and carried out missionary work in the Eastern states and, from 1839 to 1841, in England as head of the most fruitful of the Mormon missions. It was here that he first published the *Millennial Star*.

In 1834, he had accompanied Zion's Camp to Missouri to aid the beleaguered Saints, and in 1838-1839, when the Mormons were driven from that state, he organized their exodus. After the murder of Joseph Smith by mob violence in 1844, Young stepped into the leadership of the stricken and harassed people about to be driven for the fourth time from their place of settlement. Despite disorganization, fierce opposition, and

great physical hardship, he brought them across Iowa to Winter Quarters, Nebr. in 1846 and prepared them for the westward trek to Utah, having meanwhile (1844) defeated Sidney Rigdon (q.v.) for the post of church leader.

Brigham Young



The Bettmann Archive

Young sought aid from the United States government, which equipped the Mormon Battalion for a march to California as part of its operations in the Mexican War; and, to determine a place of settlement, he studied literature from government and other sources and interviewed travelers. In 1847 he led a party of 148 to the valley of the Great Salt Lake, arriving himself on July 24. On his return to Winter Quarters, he was formally elected church president.

In Utah, Young planned settlements, "calling" the settlers to a religious duty and choosing them according to needed skills. Young was appointed governor of the Territory of Utah in 1850 and again in 1854. He organized emigration from the East and brought some 70,000 persons from Europe, a success marred only by the disaster at Sweetwater River, Wyo., in October 1856, when a group of settlers traveling on foot and pushing heavy handcarts died in a snowstorm. He encouraged farming and indigenous industry, strengthening the Mormon community, but giving non-Mormons control of Utah's mineral wealth. He built canals, established cooperative irrigation and retail store enterprises, and later revived the cooperative United Order communities. Each community differed—the most extreme involving complete community living as one large cooperative family, the least involving a part-time cooperative farm or business. He also developed church-owned business interests and sponsored educational institutions, including the University of Deseret (1850), now the University of Utah.

Although not appointed governor again in 1858, Young withstood federal opposition and remained the effective authority in Utah regardless of who held the gubernatorial office. He took advantage of the coming of the railroad in 1869, a development intended to bring his downfall. Dealing sternly with dissent, he maintained his leadership over the theocratic community that he had built, with the assistance of such able lieutenants as Heber C. Kimball, Wilford Woodruff, and George Q. Cannon.

Young preached and practiced plural marriage and had 27 wives and 56 children. On his death, Utah's Mormon population had reached 140,000, comprising a widespread and distinctive community, which had survived the rigors of

settlement and of opposition that had broken out into violence in the Utah Mormon War of 1857.

See also MORMONS; UTAH—History.

THOMAS F. O'DEA  
University of Utah

**Further Reading:** Arrington, Leonard, *Brigham Young: American Moses* (Knopf 1985); Jesse, Dean C., ed., *Letters of Brigham Young to His Sons* (Deseret 1974); Stott, Clifford L., *Search for Sanctuary* (Univ. of Utah Press 1984); Werner, Morris R., *Brigham Young* (1925; reprint, R. West 1977).

**YOUNG, Cy** (1867–1955), American baseball pitcher, who won the most games in major league history. The annual awards for best pitcher, established in 1956, are named in his honor. Over 22 seasons, he won 511 games and lost a record 313. His 906 games pitched were a record until 1968, and his 7,377 innings remain a record. He won 20 or more games in 14 consecutive seasons and topped 30 wins five times. He also pitched three no-hitters, including a perfect game (against Philadelphia) in 1904.

Denton True Young was born in Gilmore, Ohio, on May 29, 1867. A farmer, he did not become a professional player until he was 23. He was dubbed "Cy," short for "cyclone," which described the velocity of his fastball.

After 11 National League seasons with Cleveland and St. Louis, he jumped to Boston of the newly formed American League and became its first pitching star. In the first World Series (1903), he defeated Pittsburgh twice as Boston won the championship.

Young's career covered the period during which the pitching mound was moved from 50 feet to 60 feet 6 inches from home plate.

Young was elected to the Baseball Hall of Fame in 1937. He died near Peoli, Ohio, on Nov. 4, 1955.

MARTIN APPEL, *Coauthor of*  
"Baseball's Best: The Hall of Fame Gallery"

**YOUNG, Edward** (1683–1765), English poet. He was born in Upham, near Winchester, England, and baptized on July 3, 1683. He attended Winchester College and various colleges at Oxford, receiving degrees in 1714 and 1719. Through Thomas Tickell he gained entrée into London literary circles and began publishing poems dedicated to prominent persons. After considerable legal maneuvering, Young obtained an annuity of £100 from the duke of Wharton. He next turned his talents to drama, producing three so-called tragedies on Oriental themes: *Busiris*, *King of Egypt* (1719), *The Revenge* (1721), and *The Brothers* (not published until 1753). From 1725 to 1728 he wrote a series of seven Horatian satires (*The Universal Passion*), which attacked folly in society. Meanwhile, hoping for quicker advancement, Young had turned to the church. After taking orders he was appointed chaplain to George II in 1728 and two years later was named rector of Welwyn. In 1731 he married Lady Elizabeth Lee and settled into a leisurely life of retirement, spent in writing poetry and entertaining prominent friends.

Young's best-known work, *The Complaint, or Night Thoughts on Life, Death, and Immortality*, appeared from 1742 to 1745. The poem, composed originally of four "Nights" or cantos in blank verse, combines a justification of Christian doctrine with autobiographical suggestions, strong macabre and sensational detail, and pious but conventional moral reflections. These ele-



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Cy Young set a big-league mark with 511 career victories.

ments are strung together on a slight thread of narrative (actually more character contrast than narrative). Lorenzo is a man of the world whose life of pleasure, which ill prepares him for death and the afterlife, is contrasted with the sudden death of Philander, a good man, and the death of the virtuous Narcissa in her youth. This sentimental and pious strain made the first four "Nights" a success. The last five sections are almost purely theological and were less popular. Few if any mid-18th century poems were more influential than *Night Thoughts*, not only in England but in France and Germany as well. The poem's melancholy, sentimentalism, preoccupation with death, and personal emotion marked its affinity with the growing romanticism of the period.

In 1759, Young wrote for a friend, the novelist Samuel Richardson, *Conjectures on Original Composition*, a piece of literary criticism that defended the romantic view of genius as extravagant, subjective, and nonimitative. This work and *Night Thoughts* placed Young as a forerunner of the romantic movement, a place that he still occupies in literary history. He died at Welwyn, Hertfordshire, on April 5, 1765.

DONALD B. CLARK  
Author of "Alexander Pope"

**YOUNG, Ella** (1867–1956), Irish author. She was born in Fenagh, County Antrim, Ireland, on Dec. 26, 1867. She moved to southern Ireland during her early childhood and became associated with the Irish literary revival in Dublin. She went to America as a lecturer in 1925, held a lectureship on Celtic literature and mythology at the University of California, and continued to live on the west coast. She died in Oceano, Calif., on July 23, 1956.

Something of a recluse, she published several

volumes of verse, prose sketches, and tales based largely upon Celtic mythology, and the autobiographical *Flowering Dusk* (1945). Much of her verse and prose creates a mysterious world of fantasy.

WILLIAM BRACY.

**YOUNG, Ella Flagg**, American educator: b. Buffalo, N.Y., Jan. 15, 1845; d. Washington, D.C., Oct. 26, 1918. She was educated at the Chicago Normal School and later studied under John Dewey, receiving her Ph.D. from the University of Chicago in 1900. She had begun to teach in 1862 and in 1868 was married to William Young, who died the next year. Mrs. Young was appointed a district superintendent of schools in Chicago in 1887, and in 1899 she became professor of education at the University of Chicago. She served as principal of the Chicago Normal School from 1905 to 1909 and then became superintendent of Chicago's public school system, from which she retired in 1915.

As a pioneer of the Dewey school in progressive education, Mrs. Young underscored the importance of concrete experience in the learning process and advocated the greatest possible personal liberty for students consistent with a sense of responsibility. She was also active in social work, with Jane Addams, and in the woman suffrage movement, and was the first woman president of the National Education Association (1910-1911). She published *Isolation in the School* (1900), *Ethics in the School* (1902), and *Some Types of Modern Educational Theory* (1902).

**YOUNG, Ewing**, American trapper, explorer, and frontiersman: b. Jonesboro, Tenn., before 1794; d. Willamette Valley, near present Newberg, Oreg., February 1841. He was the son of Charles Young, veteran of the Battle of King's Mountain in the American Revolution, and Mary Rebecca Wilkins. His early trade was carpentry. In partnership with William Becknell he took the first wagon train (four wagons) over the Santa Fe Trail from Franklin, Mo., to New Mexico in 1822—the first of seven such trips that he made over the trail in as many years.

Making Taos, New Mexico, his headquarters, he became the central figure in the Southwest fur trade, sending and leading trapping parties into the Colorado River watershed. Young also drove mules and mule stock (jacks) back over the trail to Missouri and thus played a significant part in that state's growing mule industry, which prospered because of the expanding cotton and sugar farming down the Mississippi River.

In 1829-1830 Young opened the Gila Trail, sometimes called the Ewing Young Trail, through the Southwestern plateaus and deserts to southern California. On this trip he had with him a young man, Christopher (Kit) Carson, on his first extensive trapping excursion. Young trapped the California valleys until 1834, when he led a party north to the Willamette Valley of Oregon. There he settled in the Chehalem Valley, 30 miles southwest of present Portland, and raised livestock, farmed, operated a sawmill, and ran a trading post. In 1837 he led a drive of 800 Spanish cattle north from San Francisco Bay to Oregon, reaching the Willamette Valley settlement with 630 head of much-needed livestock. His death compelled the settlers to form the first organized

government in Oregon, with the offices of probate judge, sheriff, and clerk, to probate his extensive estate.

KENNETH L. HOLMES,  
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Oregon.

**YOUNG, Francis Brett**, English novelist and poet: b. Halesowen, Worcestershire, England, 1884; d. Cape Town, South Africa, March 28, 1954. He studied medicine at the University of Birmingham and practiced in England until World War I, when he served as an army medical officer in East Africa. In the meantime he had published volumes of fiction, poetry, and criticism. *Portrait of Clare* (1927; American title *Love is Enough*) won special critical acclaim and the James Tait Black Memorial Prize. Other books include his horror romance *Cold Harbour* (1924); fictional studies of South Africa such as *They Seek a Country* (1937) and *The City of Gold* (1939); an Italian adventure story of two English spinsters, *A Man About the House* (1942); a long epic poem about the evolution and history of Great Britain, *The Island* (1944); and a descriptive volume, *In South Africa* (1952). His best novels assimilate much of his unusual versatility, exploiting his talents as poet, nature lover, musician, soldier, world traveler, and physician.

WILLIAM BRACY.

**YOUNG, Sir John, Baron Lisgar**, British political administrator: b. Bombay, India, Aug. 31, 1807; d. Bailieborough, Ireland, Oct. 6, 1876. He graduated from Oxford in 1829, was called to the bar in 1834, and sat in the House of Commons from 1831 to 1855. On the death of his father in 1848 he had succeeded to the baronetcy. Young served as chief secretary for Ireland (1852-1855) and lord high commissioner of the Ionian Islands (1855-1859) and was governor general of New South Wales from 1861 to 1867. In 1869 he was appointed governor general of Canada, where he remained until 1872. For his success in suppressing the Manitoba insurrection of 1869-1870, led by Louis Riel (see RIEL'S RISINGS—*The Manitoba Insurrection*), Young was rewarded with the title of Baron Lisgar.

**YOUNG, John Russell**, American journalist: b. Tyrone County, Ireland, Nov. 20, 1840; d. Washington, D.C., Jan. 17, 1899. He was brought to the United States as an infant by his parents and grew up in Philadelphia and New Orleans. In 1857 he became a copy boy on the *Philadelphia Press* and soon was a reporter. His coverage of the First Battle of Bull Run (July 1861) brought him national attention, and in 1862 he was made managing editor of the *Press*. Thereafter he was managing editor of the *New York Tribune* (1866-1869) and European correspondent of the *New York Herald* (from 1872), in which capacity he accompanied former President Ulysses S. Grant around the world in 1877-1879. When Chester A. Arthur succeeded to the presidency, Grant recommended Young for the post of minister to China, where he served from 1882 to 1885 and played a significant role in the negotiations that led to the French protectorate over Indochina. He was librarian of Congress from 1897 until his death. Young wrote *Around the World with General Grant* (2 vols., 1879); his *Men and Memories: Personal Reminiscences* (2 vols., 1901)



was edited by his widow, May D. Russell Young.

**YOUNG, Loretta** (originally **GRETCHEN YOUNG**), American motion picture and television actress: b. Salt Lake City, Utah, Jan. 6, 1913. She moved to Hollywood with her mother at the age of four and began to appear briefly in silent films a year later. Her career began seriously in 1927, when she won a small part in the silent picture *Naughty But Nice*. Thereafter she played leading roles in nearly 100 motion pictures, with Warner Brothers (1927-1934), Twentieth Century-Fox (1934-1940), and as a free-lance star from 1940. In 1948 she received the Academy Award for her performance in *The Farmer's Daughter*. She subsequently became one of America's favorite television actresses in the *Loretta Young Show*, which won several television Academy awards.

**YOUNG, Mahonri (Mackintosh)**, American sculptor, painter, and etcher: b. Salt Lake City, Utah, Aug. 9, 1877; d. Norwalk, Conn., Nov. 2, 1957. A grandson of Brigham Young, the Mormon leader, he studied at the Art Students League in New York City and the Julian Academy in Paris, and subsequently taught for many years at the Art Students League. Young is widely known for his simple and realistic bronzes of workmen and prizefighters and his etchings of city scenes. The Sea Gull Monument to the Mormon leaders in Salt Lake City and a statue of his grandfather in the Capitol in Washington, D.C., are among his major works. He also modeled the Hopi and Apache Indian groups for The American Museum of Natural History in New York City.

**YOUNG, Owen D.**, American lawyer, industrial executive, and statesman: b. Van Hornesville, Herkimer County, N.Y., Oct. 27, 1874; d. St. Augustine, Fla., July 11, 1962. He graduated from St. Lawrence University, in Canton, N.Y., in 1894 and from Boston University Law School in 1896. He then practiced law in Boston until 1912 and lectured at Boston University Law School until 1903. After fighting a case against a General Electric subsidiary in 1912, Young was invited to become general counsel of the General Electric Company in 1913 and eventually was chairman of the board (1922-1939, 1942-1944). Meanwhile, at President Woodrow Wilson's request, he had organized the Radio Corporation of America in 1919 to strengthen the position of the United States in international communications, serving as chairman of its board until 1929 and chairman of the executive committee until 1933. Young was also a director of the Federal Reserve Bank of New York (1923-1940) and of many large corporations, and a trustee of a number of leading educational institutions.

Young's greatest distinction was his service as an international statesman, especially in the liquidation of financial problems after World War I. He was coauthor with Vice President Charles G. Dawes of the so-called Dawes Plan, which fixed the amount and method of payment of German reparations at the London Reparations Conference of 1924; and as conciliator at the London Conference of Premiers that followed, he was credited with being the major influence in inducing acceptance of the plan by the Allied governments. Then, at the invitation of the European governments, but without encouragement from the United States, Young presided at the following Paris Reparations Conference in 1929. The

problem of moderating Allied demands by considering Germany's capacity to pay presented great difficulties, and the Young Plan that emerged was hailed at the time as one of the greatest diplomatic triumphs ever attained.

Young was remarkable for his capacity to analyze difficult industrial and political problems, to invent solutions, and to gain acceptance by conciliating opposing points of view. He was also noted for his modesty, illustrated by his refusal to be honored by a great reception planned for him in New York City after the acceptance of the Young Plan. After his retirement in 1939, he engaged in dairy farming in his native town. He had previously donated his collection of rare books and manuscripts, valued at more than \$1 million, to the New York Public Library.

QUINCY WRIGHT,  
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versity of Virginia.

**YOUNG, Rida (Johnson)**, American playwright and musical comedy librettist: b. Baltimore, Md., 1875; d. Stamford, Conn., May 8, 1926. After coming to New York City as an aspiring young playwright, she spent several years as a minor actress and a writer of popular song lyrics for a music publisher before completing her first satisfactory play, *Glorious Betsy*. Her first real success, *Brown of Harvard*, was produced in 1906, followed by *The Boys of Company B* (1907) and *The Lottery Man* (1909). In 1910 she prepared the book and lyrics for Victor Herbert's *Naughty Marietta*. For the popular entertainer Chauncey Olcott she wrote *Barry of Ballymore* (1911), including the words for the popular song, *Mother Machree*. This was followed by *Isle of Dreams* (1912) and *Shameen Dhu* (1913). Later she did the dramatic adaptation for Sigmund Romberg's first great success, *Maytime* (1917); the book and lyrics for Rudolf Friml's *Sometime* (1918); and other librettos. Her comedies *Captain Kidd Junior* and *Her Soldier Boy* were produced in 1916; *Little Old New York*, in 1920.

WILLIAM BRACY.

**YOUNG, Robert Ralph**, American financier and railway executive: b. Canadian, Texas, Feb. 14, 1897; d. Palm Beach, Fla., Jan. 25, 1958. After engaging in varied business activities through the 1920's, he emerged from the stock market crash of 1929 with a reputed \$1 million, made by selling short, and became a partner in the brokerage firm of Young, Kolbe, and Company in 1932. In 1937, with the backing of financier Allan P. Kirby, he bought heavily into the Alleghany Corporation, a railroad holding company. After a series of legal and financial battles, he took control in 1942, becoming board chairman of Alleghany and one of its assets, the Chesapeake and Ohio Railway Company. Young's vigorous attack on existing methods of railway finance and operation made him one of the most controversial figures in modern railroad history. He pioneered in the establishment of competitive bidding for railway bonds, and his innovations in railway operation included the first "through" transcontinental passenger train service.

Young's apparent overriding ambition was to establish a transcontinental system with the New York Central Railroad as its pivotal line, and he used a spectacular proxy fight in 1954 to wrest

control of the Central from New York investment banking interests. Named board chairman of the Central, he sought to end the road's financial problems and at first the stock rose. But he was unable to overcome the carrier's increasingly difficult plight, and early in 1958 the value of Central stock sank. On January 20 the Board of Directors decided against declaring the quarterly dividend. Five days later, Young took his own life with a shotgun.

**YOUNG, Stark**, American drama critic and novelist: b. Como, Miss., Oct. 11, 1881; d. Fairfield, Conn., Jan. 6, 1963. After studying at the University of Mississippi and Columbia (M.A., 1902), he spent almost 20 years teaching, resigning as professor of English at Amherst in 1921 to join the editorial staffs of the *New Republic* and *Theatre Arts Monthly*. As drama reviewer and essayist for these magazines during the next two and a half decades and as drama critic for the *New York Times* during the year 1924-1925, he became a vital influence in the New York theater world. He had published early poems (*The Blind Man at the Window*) and *Guinevere*, and the first of several plays, in 1906. His essays on theater art and drama are collected in *The Flower in Drama* (1923), *Clamour* (1925), *Theatre Practice* (1926), *The Theatre* (1927), and *Immortal Shadows* (1948).

During the decade 1926-1935, Young achieved prominence as a writer of historical fiction, and he was associated with the Southern agrarians as a contributor to the symposium *I'll Take My Stand* (1930). His *So Red the Rose* (1934), one of the finest and most popular of Civil War novels, depicts the tragic impact of war on the old plantation way of life in the vicinity of Natchez, Miss. *Heaven Trees* (1926), his first novel, gives an earlier glimpse at the old way of life, treating some of the same characters and their relatives in northern Mississippi during the 1850's. Two other novels, *The Torch on Flare* (1928) and *River House* (1929), study the effects of these changing conditions on members of Young's own generation. Two volumes of short stories that followed, *The Street of the Islands* (1930) and *Feliciania* (1935), complete the series.

Young made lasting contributions to American letters both as drama critic and as novelist. Other important publications include autobiography (*The Pavilion*, 1951) and translations from Anton P. Chekhov (*Best Plays*, 1956). After retiring in 1947 as drama critic he turned his creative efforts to art and received some attention as a painter.

WILLIAM BRACY  
Department of English  
Beaver College

**YOUNG, Thomas**, English physicist and physician: b. Milverton, Somersetshire, England, June 13, 1773; d. London, May 10, 1829. Of Quaker parentage, he read fluently at the age of 2 and by 14 had mastered Latin, Greek, French, Italian, Hebrew, Persian, and Arabic. He studied medicine in London, Edinburgh, Göttingen (M.D., 1796), and Cambridge, and in 1799 established himself as a physician in London. From 1801 to 1803 he was professor of natural philosophy at the Royal Institution, publishing *A Course of Lectures on Natural Philosophy and the*

*Mechanical Arts* (1807), based on his courses there. In 1802 he became foreign secretary of the Royal Society, of which he had been elected a fellow in 1794, and he held this office for the remainder of his life. In 1811 he was elected physician to St. George's Hospital in London, a post he also held until death, and in 1818 he was appointed secretary to the Board of Longitude, superintending the preparation of the *Nautical Almanac*.

Young strongly supported Christian Huygens' wave theory of light, mainly by virtue of his now famous double-slit experiment (1801) demonstrating the interference of light waves (see *LIGHT—The Wave Theory*). He was the first to describe and measure astigmatism (1801). He also proposed a theory of color vision later developed by Hermann Ludwig Ferdinand von Helmholtz and known as the Young-Helmholtz theory, and made important contributions to the theories of elasticity (Young's modulus of elasticity), hemodynamics, capillarity, and tides.

Young's amazing versatility is further evidenced by the fact that he became a noted Egyptologist, being among the first to decipher Egyptian hieroglyphic inscriptions, including the Rosetta stone (1818), and to work out the hieroglyphic alphabet. Among his many important papers is *An Account of the Recent Discoveries in Hieroglyphical Literature and Egyptian Antiquities* (1823).

**YOUNG, Whitney Moore, Jr.** (1921-1971), American educator, social work administrator, and civil rights leader. He was born at Lincoln Ridge, Ky., on July 31, 1921, and received degrees from Kentucky State College (B.S., 1941) and the University of Minnesota (M.A., 1947). He taught at the Nebraska School of Social Work, Creighton University, and the Atlanta University School of Social Work, where he was dean from 1954 to 1961.

In 1961, Young became executive director of the National Urban League (q.v.), a biracial organization formed to secure equal opportunities for Blacks. Elements of his "domestic Marshall Plan" were incorporated into the federal antipoverty program during the 1960's. Among his writings is *To Be Equal* (1964). Young died in Lagos, Nigeria, on March 11, 1971.

C. ERIC LINCOLN  
Union Theological Seminary

**YOUNG IRELAND**, a radical Irish political group active between 1840 and 1850. They first followed Daniel O'Connell, who worked for Catholic emancipation. The Young Ireland adherents soon became more extreme in their opinions, advocated physical force, and in 1844 separated from the more conservative Irish nationalists.

Among the party leaders were Charles Gavan Duffy, Thomas O. Davis, and John Blake Dillon, whose political journal, the *Nation*, constantly incited the Irish people to revolt. In 1848 John Mitchel, one of the leaders of the party, was arrested for treason and sent to Tasmania. The attempted insurrection which followed soon collapsed. Two other leaders, Thomas Francis Meagher and William Smith O'Brien, were transported also. Later Mitchel and Meagher and many other Young Irelanders escaped and began to organize Irish resistance overseas. See also **HOME RULE; IRELAND—History**.

**YOUNG ITALY (GIOVINE ITALIA)**, an Italian political society formed in 1831 by Giuseppe Mazzini (q.v.), whose aims were the emancipation of Italy from domestic and foreign (chiefly Austrian) tyrannies, and the unification of the country under a republican government. Its activities declined after 1834, when Mazzini led an unsuccessful invasion of Savoy, but the society was of service in arousing Italian patriotism, and it formed the model for similar organizations elsewhere in Europe. See also **ITALY—3. History** (From the French Revolution to Unification): Restoration and Risorgimento.

**YOUNG MEN'S AND YOUNG WOMEN'S HEBREW ASSOCIATION (YM-YWHA) or JEWISH COMMUNITY CENTER**, a type of Jewish community organization in the United States, Canada, and other countries, providing social, cultural, physical education, and camping activities for all age groups. Its aim is to perpetuate Judaism as a positive factor in community life through recreation, health education, democratic training, and informal education in Jewish culture. Until the early 1930's, the "Y's" were primarily youth-serving agencies, although in their earlier days they played a significant role in the United States in the adjustment of immigrants to American life. As they broadened their programs to include all elements in the Jewish community, the name Jewish Community Center was more generally adopted, but a few of the oldest and some of the newest units continue to favor the older YM-YWHA designation.

The centers trace their origin to Jewish young men's literary societies established in various American cities in the 1840's. The first organization to be called the Young Men's Hebrew Association (YMHA) was formed in Baltimore, Md., in 1854. The YMHA in New York City was founded in 1874. The name Young Women's Hebrew Association (YWHA) was first applied to a woman's auxiliary of the New York organization in 1888, and the first independent YWHA was founded there in 1902. The YM and YWHA's eventually merged everywhere into single organizations.

In 1913 the National Council of Young Men's Hebrew and Kindred Associations was formed, uniting 175 YM and YWHA's throughout the United States. This, in turn, merged in 1921 with the National Jewish Welfare Board (JWB), founded in 1917 to provide for the religious needs and welfare of Jews in the United States armed forces in World War I. The JWB, with headquarters in New York City, continues to serve as the national association of Jewish community centers and "Y's" in the United States. The local centers are autonomous, but the JWB provides important aid in planning and programming; personnel recruitment, training, and placement; building planning and construction; and administrative services and publications. The parallel organization in Canada is the Canadian Council of YM-YWHA's, whose headquarters are in Toronto. The center movement has now taken root throughout the free world, particularly in western Europe and Israel. The associations in some 19 countries are linked through the World Federation of YMHA's and Jewish Community Centers, founded in 1946, with headquarters in New York City.

By the mid-1960's there were more than 300 Jewish community centers or "Y's" in over 240

cities of the United States and Canada, with a combined membership of nearly 700,000. These centers employed more than 1,500 professional social group workers and maintained, owned, or sponsored some 275 day camps and over 100 resident summer camps. Characteristic activities, covering all age groups, include arts and crafts programs, dramatics, physical and health education, music groups, concerts, hobby groups, lectures, forums, and camping. Nursery schools are maintained and special "golden age" clubs for the elderly. On a national scale, the JWB sponsors an annual Jewish Book Month, Jewish Music Festival, and Jewish Youth Week, in which the centers participate. Its Jewish Community Center World Fellowship project provides opportunities for cultural and athletic contacts between center members in the United States and their counterparts in Israel, Canada, Latin America, and Europe.

BERNARD POSTAL,  
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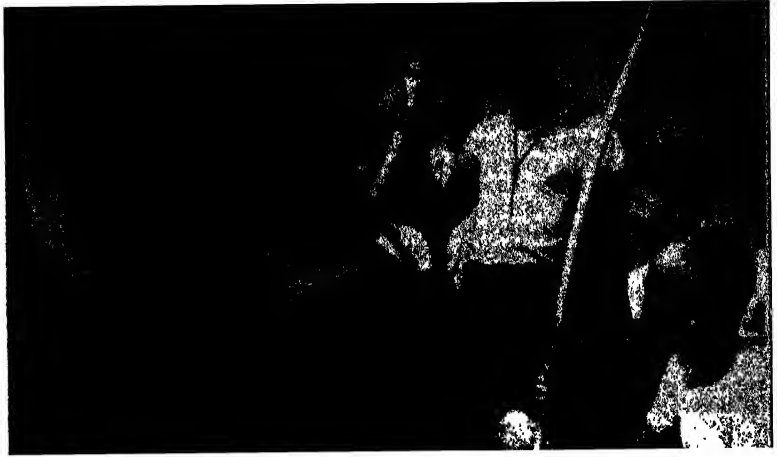
**YOUNG MEN'S CHRISTIAN ASSOCIATION (YMCA)**, an organization defined in the constitution of the National Council of the YMCA's in the United States as a "worldwide fellowship united by a common loyalty to Jesus Christ for the purpose of developing Christian personality and building a Christian society." The Christian orientation of the "Y" is intended to define its purposes and the influence it seeks to exert, not to exclude any who share its ideals or who wish to participate in its activities. Composition of the membership varies from country to country, according to the national pattern, whether Protestant, Roman Catholic, Orthodox Eastern, or other. In the United States the members are predominantly of Protestant affiliation or background, but include substantial numbers of Roman Catholics, members of the Orthodox Christian churches, Jews, and persons of other or no religious affiliation. Since the early 1930's the associations in the United States have accepted women and girls as members along with men and boys.

By the 1960's the more than 1,800 YMCA's in the United States had a membership of about 2,800,000, representing a growth of over 50 percent since 1950. Of this total, almost a quarter were women and girls, and about three fifths were under 25 years of age. Total world membership was about 4,000,000.

**Activities and Organization.**—YMCA's in American communities are usually organizations of substantial size, with specialized "Y" buildings making possible a wide variety of social, cultural, athletic, and other recreational activities. The practical working objective of these programs is to provide experience that will help members and other participants (1) to understand, accept, and respect themselves as individuals; (2) to develop a faith to live by, based on the life and teaching of Jesus; (3) to form habits of health and physical fitness; (4) to grow as responsible members of their families; (5) to accept the privileges and responsibilities of citizenship in their own groups and in community life; (6) to develop and work for interracial and intergroup understanding; (7) to develop a sense of world-mindedness; and (8) to develop and use responsibly whatever capacities for leadership they possess. To these ends the local associations present programs that include all-around interest clubs for young men and young

Group activities directed toward physical fitness and good citizenship are part of the YMCA program.

YMCA



women and for high school and grade school youth, adult education classes and groups (vocational and cultural), physical fitness classes, swimming and water safety instruction, public affairs forums, religious study groups, choruses, orchestras, youth and family camps, and educational travel opportunities.

Each local YMCA is an autonomous organization, with management in the hands of a lay board of directors, elected by the members, and related committees and councils. Program and group-activity leaders are mostly volunteers. Board, committee, council, group, and club leadership posts in the associations of the United States numbered over 400,000 by the 1960's. There were also about 4,000 full-time professional staff members, including professionally trained secretaries, youth and adult program directors, and directors of physical education, responsible for over-all direction and supervision.

Local associations in the United States are affiliated through the National Council of Young Men's Christian Associations and 17 area councils or state committees, which provide service and leadership to strengthen the local associations in program adaptation and invention, personnel recruitment and training, administration, building design, fund raising, and management. A similar national council exists in Canada. The national councils of the United States and Canada are active participants in the World Alliance of Young Men's Christian Associations, with headquarters at the John R. Mott House in Geneva, Switzerland, which federates YMCA effort in 83 countries. Under its guidance, a World Service gives aid in professional personnel and project support for the development of YMCA's all over the world. Through this agency the North American YMCA's have contributed to the development of Young Men's Christian Associations in 46 of the 83 countries where the "Y" has been established.

**History.**—The first Young Men's Christian Association was organized in 1844 by George Williams (q.v.), then a 22-year-old dry-goods clerk in London, England. Its stated purpose was to improve the spiritual condition of young men in the drapery and other trades. This aim was quickly expanded to cover the "spiritual and mental" interests of the participants. Religious meetings and personal counsel to young men coming into the city were primary activities, and the first center was a reading room.

Associations on the London pattern were organized in Montreal, Canada, and Boston, Mass., in 1851. In 1854 the associations in the United States and Canada formed an International Com-

mittee for mutual aid and to encourage the organization of new associations; in 1912 a separate national council was organized in Canada, and in 1924 in the United States. Meanwhile, the idea had also taken root on the European continent. In 1855 a world conference of YMCA's was convened in Paris, with representatives from Belgium, the British Isles, Canada, France, Germany, Holland, Switzerland, and the United States, and this conference established what is now known as the World Alliance of Young Men's Christian Associations.

The program characteristic of the American YMCA's got its impetus in 1886, when the association in New York City stated its objective to be the improvement of the spiritual, mental, social, and physical condition of young men. In 1869 the associations in San Francisco, Washington, D.C., and New York City constructed new buildings which included gymnasiums. In 1885 the Brooklyn Central "Y" added a swimming pool. Basketball was invented in 1891 at the YMCA's training school, Springfield College, in Massachusetts, by a staff member, James Naismith (q.v.). Volleyball was invented at Holyoke, Mass., in 1895 by the "Y" physical director, William G. Morgan. Luther Halsey Gulick (q.v.), of Springfield, stressed the concern for "wholeness" of life—spirit, mind, body—in introducing the triangle as the association's symbol.

The YMCA began to undertake service to members of the armed forces in the United States through a Christian Commission during the Civil War. It supplied many services during World War I at the request of the War Department and aided prisoners of war on both sides, working through neutrals. During World War II it was one of the six member agencies of the United Service Organizations (USO).

Associations were organized on the campuses of the state universities of Michigan and Virginia in 1858. In 1895, the leader of the college and university associations in the United States, John Raleigh Mott (q.v.), was a prime mover in bringing together student movements around the world in the World Student Christian Federation. Specialized work with boys began in 1869. A camp for boys was started in 1885 at Orange Lake, N.Y. Later came Hi-Y clubs of senior and junior high school boys (now including girls as well), Gra-Y clubs of grade school boys and girls, and a Y-Indian Guide program for fathers and sons.

A YMCA was established in Calcutta, India, in 1854, but it did not survive. Several associations started in the mid-1870's did; these and others were spurred greatly by aid from a North

American fraternal secretary beginning in 1889. In Japan and China the YMCA was introduced in missionary schools in the late 1880's, and then in the major cities, also with North American assistance. An association was organized in Cairo, Egypt, in 1892 with staff help from England. From similar beginnings the YMCA has grown throughout Asia, Africa, the Middle East, and Latin America. Stress in aid is now on self-led associations, Christian in orientation but related to nation building in the countries themselves.

YMCA's were still active in Communist China in the early 1960's, though with what freedom was not known; they had played no part in the world organization since the revolution. There were no YMCA's in the USSR or European Communist countries. Exchanges for mutual understanding, however, between the YMCA's of the United States and Communist youth organizations were growing in number.

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**Further Reading:** Garrett, Shirley, *Social Reformers in Urban China: The Chinese YMCA, 1895-1926* (Harvard Univ. Press 1970); Macleod, David I., *Building Character in the American Boy: The Boy Scouts, the YMCA, and Their Forerunners, 1870-1920* (Univ. of Wis. Press 1983); Zald, Mayer N., *Organizational Change: The Political Economy of the YMCA*, ed. by David P. Street (Univ. of Chicago Press 1970).

**YOUNG PRETENDER.** See STUART, CHARLES EDWARD LOUIS PHILIP CASIMIR.

**YOUNG WOMEN'S CHRISTIAN ASSOCIATION (YWCA)**, a worldwide organization designed to promote the welfare of women and girls everywhere, regardless of race, class, creed, or nationality. It was founded in England in 1855 as two separate groups: a Prayer Union, established by Emma Roberts, and the General Female Training Institute, founded by Mary Jane Kinnaird (Lady Kinnaird). The purpose of both groups, which soon united as the YWCA, was to improve the situation of women under conditions brought about by the Industrial Revolution. By 1858 the movement had spread to New York City, and in 1866 a YWCA was opened in Boston. Thereafter the movement expanded rapidly throughout the United States and other countries, becoming one of the largest and most influential world organizations of women. By the 1960's membership in the United States was more than 2,000,000.

**Purpose and Organization.**—From its earliest beginnings the YWCA has brought women and girls together to work on their common problems and interests, and aspirations for human welfare. All of its activities have been motivated by its deeply rooted Christian purpose, expressing itself in deeds: "To build a fellowship of women and girls devoted to the task of realizing in our common life those ideals of personal and social living to which we are committed by our faith as Christians. . . . In this endeavor we seek to understand Jesus, to share His love for all people, and to grow in the knowledge and love of God." Membership in the YWCA is open to all girls and women without subscribing to this purpose, but those who do subscribe to it have the opportunity to take part in determining the continuing program of the association and to become eligible for positions of leadership. The

insignia of the organization, an inverted triangle, symbolizes the threefold emphasis of the YWCA program—growth of body, mind, and spirit.

In the United States, YWCA's have been united since 1906 in a national association called the Young Women's Christian Association of the United States of America, whose executive body is the National Board, with headquarters in New York City. The board is chosen to carry out policies and principles adopted by the voting delegates at national conventions held every three years. The national association, in turn, is affiliated with the World YWCA, founded in 1894, with headquarters at Geneva, Switzerland, which by the 1960's united YWCA organizations in 72 countries throughout the world. In the United States there were YWCA programs in some 4,600 locations, including over 400 community YWCA's, more than 200 branches and centers, over 100 resident camps, about 300 residences, and nearly 500 student associations.

**Activities.**—The YWCA provides activities for groups of all ages and interests. The Y-Teen program, for girls and boys, offers recreation, education, citizenship training, service projects, and opportunities to develop social relationships. A program for young adults provides activities for married and unmarried working women, and often for men under 35. Included in the Young Adult group is the Y-Wives program of recreational and educational activities for young mothers of children under school age. The YWCA also serves an increasing number of families with hobby groups, classes, job training, gymnastics, camping, sports, and a wide variety of projects designed for the enjoyment and development of entire households and the consequent strengthening of family life. In all the principal cities of the United States, the YWCA continues to help meet an important need through its residences for young women who are beginning their work experience in new surroundings.

The college and university YWCA program, dating from 1873, offers students opportunities for freedom of inquiry and expression regarding the Christian religion. The campus groups constitute a source of leadership, not only for the YWCA, but for the communities in which these young persons work after graduation.

The YWCA places strong emphasis on its international character. As a part of the mutual service program of the World YWCA, the International Division of the YWCA in the United States offers regular aid to national associations in some 25 or 30 countries by providing advisory secretaries, program and money grants, and international leadership training. The first American advisory secretary went overseas in 1894. Such secretaries help other countries to develop YWCA's of their own, assist in leadership training, and provide general advisory services for founding, strengthening, and expanding the programs of YWCA's abroad.

In times of national emergency, the YWCA has taken a leading role. In World War I it carried on an extensive program for armed services personnel in the United States and overseas. This work, financed in cooperation with a group of other national organizations engaged in similar services, was the forerunner of the United Service Organizations (USO) of World War II. In 1940 a World Emergency Committee was formed for relief work overseas, and the following year the YWCA of the United States was one of the six



founding organizations of the United Service Organization (USO), in which it continues to participate.

Throughout its history, the YWCA has encouraged certain aspects of its program in the United States to develop into independent movements. Organizations which had their beginnings in the YWCA include the National Travelers Aid Association, the American Council for Nationalities Service, and the National Federation of Business and Professional Women's Clubs, as well as day nurseries and women's exchanges. Another prominent outgrowth of YWCA work is the expansion and intensification of the concept of group work, now a major concern of social-work teaching and practice.

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**YOUNGBERRY**, a trailing blackberry, originated by Byron M. Young of Louisiana in 1905 as a hybrid between the Phenomenal and the Mayes dewberry. Also called the Young dewberry, it was introduced commercially about 1926. Because of its high flavor and productiveness it soon became an important variety in Southern and Pacific Coast states. In 1936 the Boysen dewberry (boysenberry) was introduced. It is very similar to the youngberry but has larger and tarter berries, which ripen about ten days later than the youngberry's. The boysenberry has largely replaced the youngberry on the Pacific Coast, but both are grown to some extent from the northern part of Florida to Texas and Oklahoma, and as far north as southern Missouri and southeastern Virginia. The youngberry is not fully hardy farther north, nor is the climate of central Florida cold enough for it to grow well. The berry is one of the finest flavored of the bramble fruits, wine red when ripe, but too soft to allow it to be shipped great distances. It is highly prized as a frozen product and for jam and pies. It ripens over a period of several months, just after the strawberry.

The growth and culture of the youngberry are similar to those of the boysenberry. It is not resistant to leaf spot and anthracnose, and it occasionally sports to a thornless type that is not as productive as the thorny youngberry. Several new varieties similar in growth and berry have been bred and introduced by the Oregon Agricultural Experiment Station and the United States Department of Agriculture. Among them are Cascade (finest flavor), Chehalem (black), Marion (black), Olallie (black), and Aurora (early, firm). However, these varieties are still adapted only to the growing conditions in the Pacific Coast States.

See also **BOYSENBERRY**; **DEWBERRY**.

GEORGE M. DARROW  
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**YOUNGER, Cole** (1844–1916), American outlaw, who was a member of the James gang. Thomas Coleman Younger was born near Lees Summit, Jackson county, Mo., on Jan. 15, 1844. His service as a Confederate guerrilla officer during the Civil War caused his family to be persecuted by Union sympathizers, and in 1862 his father, though a Unionist, was murdered by a company

of Union guerrillas. After the war, Cole and three of his brothers joined the Jesse James gang, organized in 1866 (see **JAMES, Jesse**). Cole took a prominent part in most of its exploits until wounded and captured with his brothers James and Robert in an unsuccessful holdup of the bank in Northfield, Minn., on Sept. 7, 1876, during which two townspeople were killed. The Youngers, pleading guilty, were sentenced to life imprisonment; Robert died in prison in 1889, but in 1901 Cole and James Younger were paroled, thanks to the former Confederate officer Warren C. Bronaugh, who contended that they had become criminals because of the treatment of their family during the Civil War. Pardoned in 1903, Cole returned to Missouri. He made lecture tours and once appeared in a Wild West show. He died in Lees Summit on March 21, 1916.

**YOUNGHUSBAND, Sir Francis** (1863–1942), British explorer and political administrator in India, who was instrumental in opening Tibet to British trade. He was born in Murree, India (now in Pakistan), on May 31, 1863. The son of a senior officer of the British Army in India, he was trained at the Royal Military College, Sandhurst, joined the 1st Dragoon Guards in India in 1882, and in 1890 was transferred to the Indian Political Department. Meanwhile, in 1886, he had begun his explorations as a member of a government of India mission to Manchuria. He traveled through central Asia, discovered the Aghil mountains, and proved that the Great Karakoram was the water divide between India and Turkestan before returning to India from Peking via Sinkiang in 1887. The neighboring Pamirs, the "Roof of the World" (now mostly comprised in the Tadzhik Republic of the USSR), were penetrated by him in 1889, when he also made a survey of Hunza, which Russia was eyeing. Younghusband was in the Pamirs again in 1890–1891, and after the British occupation of Hunza in 1892, he was made political officer there. He subsequently served as political agent or resident in various princely states and in 1896–1897 was correspondent of the London *Times* in the Transvaal and Rhodesia.

As Russian influence in Tibet became of increasing concern to the British, Younghusband was sent as envoy to Lhasa in July 1903 with an escort of 200 Sikh pioneers. No entry permit was forthcoming from the Tibetan government, however, and London decided to send the mission in with a brigade under Col. James R. L. Macdonald. After a difficult and long advance and several minor actions, the mission and its escort marched into Lhasa on Aug. 3, 1904. A treaty signed on September 7 marked the successful accomplishment of its objective to open Tibet to British trade (see also **TIBET—History**). Younghusband was rewarded with promotion to lieutenant colonel and a knighthood. He returned to England in 1905 and lectured at Cambridge but subsequently went back to India and was a British resident in Kashmir (1906–1909). After his return to England, he became president of the Royal Geographical Society (1919) and helped to organize several of the earlier attempts to scale Mount Everest. His many books include *Heart of a Continent* (1896); *India and Tibet* (1910); *The Epic of Mount Everest* (1927); *Life in the Stars* (1928); *The Living Universe* (1933); and *The Sum of Things* (1939). He died in Lytchett Minster, Dorset, on July 31, 1942.

**YOUNGSTOWN**, a city in northeastern Ohio, the seat of Mahoning county, on the Mahoning River, 65 miles (105 km) southeast of Cleveland. Lying about halfway between New York and Chicago and midway between Cleveland and Pittsburgh, and situated near coalfields, Youngstown has an ideal location for manufacturing and distribution. It is a city of heavy industry and one of the leading steel-producing districts of the United States. Besides steel, its industries manufacture aluminum extrusions, asphalt pavers, automotive equipment, office furniture, cement and cement products, corrugated containers, forgings, dies and jigs, rolling-mill machinery, and other products.

Youngstown's economy was shaken in 1977-1978 when Youngstown Sheet and Tube, a big steel company, laid off 5,000 workers and merged with another steel company, forming the third-largest steel company in the nation.

The Ohio Turnpike has three interchanges to the city. Youngstown is also served by six railroads and by trucking facilities and bus lines. The Youngstown municipal airport is the home base of the largest fleet of executive planes in the country.

Recreational facilities include beautiful Mill Creek Park. It covers 2,383 acres (955 hectares) and contains 37 miles (60 km) of drives and foot trails.

Youngstown's musical activities are provided by the Monday Musical Club and the Youngstown Symphony Society. The Youngstown Playhouse conducts a year-round community drama program. The Butler Institute of American Art has paintings, casts, and sculptures. A large collection of historical objects related to the Mahoning region is in the Arms Museum of the Mahoning Valley Historical Society. An extensive public-library system serves the county and includes bookmobile services. Youngstown State University and Penn-Ohio Junior College are in the city.

Youngstown was named after John Young, who came to the area in 1797 and bought an entire township from the Connecticut Land Company. After small pockets of iron ore were discovered, Daniel and James Heaton built the first blast furnace in Ohio in 1803. Afterward, coal and limestone were discovered nearby, both of which are used in smelting iron ore, and Youngstown became a leading producer of iron. In 1895 the first steel was poured, and Youngstown converted from iron to steel production. Over the years, miles of steel plants were built along the Mahoning River.

Youngstown was organized as a township in 1802, incorporated as a town in 1848, and chartered as a city in 1867. The city's government operates under a home-rule charter and has a mayor-council form of government. The mayor and the eight council members are elected to two-year terms. Population: 95,732.

**YOUNGSTOWN SHEET & TUBE CO. v. SAWYER**, a 1952 ruling of the U. S. Supreme Court nullifying President Harry Truman's seizure of the steel mills. When steelworkers threatened a nationwide strike the president ordered Secretary of Commerce Charles Sawyer to seize the mills, arguing that the U. S. war effort in Korea might be crippled. In June 1952, however, the court nullified the seizure, holding in a 6-3 decision that the president had violated the principle of separation of powers.

**YOUNGSTOWN STATE UNIVERSITY**, a public institution of higher learning in Youngstown, Ohio. It offers associate, bachelor's, and master's degrees in chemistry, engineering, engineering technology, music, teacher education, and technical nursing. Enrollment is about 10,000.

Youngstown State University was established as the School of Law of the Youngstown Association School, with first instruction offered in 1908. It was chartered as an independent institution in 1920 and was named the Youngstown Institute of Technology the following year. It adopted its present name in 1967.

**YOUTH.** See **ADOLESCENCE.**

**YOUTH**, a short story by the English author Joseph Conrad, written in June 1898. It was published in *Blackwood's Magazine* in September 1898 and, together with *Heart of Darkness* and *The End of the Tether*, in the volume entitled *Youth* (1902).

The narrator Marlow, a character also used in other works, recounts what is actually an autobiographical record of Conrad's first voyage to Asia (1881-1883) aboard the *Palestine*, here named the *Judea*. The old ship, captained by an old man on his first command, has to return to dock three times for repairs. Landsmen jeer at the *Judea* and say she will never get to Bangkok, which to the 20-year-old second mate Marlow is a magic name. It is a story of youth's quest of the unknown, the romantic, the dream that is challenged by grim, unforeseen realities. When the ship leaks, her crew pumps out water, but in the Indian Ocean the cargo of coal catches fire, and they have to pump water into her. So "man is born to trouble, to leaky ships, and to ships that burn." *Youth*, noted for its narrative skill, is an early Conrad work of poetic power.

R. W. STALLMAN, Editor of "The Art of Joseph Conrad: A Critical Symposium"

**YOUTH EMPLOYMENT AND DEMONSTRATION PROJECTS ACT**, a federally funded U. S. program designed to alleviate unemployment among young people. Funded under the federal Comprehensive Employment and Training Act (CETA), the act is implemented under four overall programs.

The Young Adult Conservation Corps, modeled on the Civilian Conservation Corps of the 1930's, provides conservation-related jobs in national forests and other public lands. It complements an earlier program, the Youth Conservation Corps, that provides teenagers with summer conservation jobs. The Youth Community Conservation and Improvement Projects distribute money to states and localities to provide work renovating public buildings, improving inner-city housing, and maintaining parks and other public urban areas. Youth Incentive Entitlement Pilot Projects are designed to offer incentives to disadvantaged youths to remain in high school or to induce dropouts to return to school. The projects guarantee part-time jobs during the school year and full-time jobs during the summer. The Youth Employment and Training Program sets up work-study arrangements with school vocational departments, arranges apprenticeships, and offers academic credits. A portion of the funding of the Youth Employment and Demonstrations Projects Act is set aside for young American Indians and young members of migrant worker families.

**YOUTH HOSTEL**, hos'tel, a form of low-cost accommodation for travelers, particularly young people on hiking, bicycling, and horseback-riding trips. Persons who use hostels are called hostellers, and traveling between hostels is called hosteling. The idea for hostels first occurred to the German teacher Richard Schirrmann in 1909, and by 1911 he had 17 hostels operating in Germany. Youth hostels were introduced in the United States in 1934 by Isobel and Monroe Smith at Northfield, Mass.

More than 60 nations throughout the world have youth hostels affiliated with the International Youth Hostel Federation. The number of hostels in each country varies from fewer than 10 in Iceland to more than 950 in Poland. Japan has more than 500, many in scenic tourist areas. Large numbers of hostels are located in western Europe and the British Isles, as well as in the eastern European nations of Poland, Czechoslovakia, Hungary, Bulgaria, and Yugoslavia. Hostels can also be found in Latin America, Africa, India, Australia, and the Philippines.

The United States has more than 300 hostels, with the densest concentrations in the Northeast, the Great Lakes area, the Rocky Mountains, and the Northwest. Most of these hostels are privately owned and often operated by the owners as a part-time hobby or as a source of supplementary income. Hostellers pay modest fees. Maximum stay at a hostel is three nights, except by special arrangement. Alcohol and drugs are not permitted, and smoking is allowed only in designated areas.

In the United States and Canada, a hostel may be located in a college dormitory, a converted church, a mountain lodge, or, as in Ottawa, in an old city jail. In other parts of the world hostels can be found in medieval castles, old mills, or former railway stations. In Sweden, a three-masted sailing vessel moored in Stockholm harbor serves as a hostel.

Membership in American Youth Hostels, Inc. (AYH) is open to everyone, and there is no age limit. Membership in AYH has grown steadily from about 11,500 in 1954 to more than 90,000. The AYH pass is valid at any of the more than 5,000 hostels in the world. In addition to individual passes, AYH offers a family pass, which is honored only in the United States and Canada. Families anticipating travel abroad need to buy individual passes for each member of the family. Some hostels have family quarters available, but most often hostelling families have to conform to dormitory-style arrangements. Passes are issued for the calendar year and are good through December of the year of issue.

Hostels are often located 10 to 15 miles (16–24 km) apart, in loops or circuits, so that hostellers can hike in a day from one to another. Since the emphasis is on physical exercise, public or motor transportation is ordinarily used only to reach the start of a hostel circuit.

Hostellers are expected to do simple chores, such as cleaning up after themselves, making beds, doing dishes, sweeping floors, and the like. The basic premise of hosteling is to leave a place better than one found it. In the United States hostels are supervised by "houseparents." Outside the United States custodians are generally paid, and the hostels are usually owned by the hostel organizations themselves, with or without subsidies from local or national governments, or private philanthropies.

Many schools in the United States have organized hostel clubs. The AYH sponsors bicycling and camping trips of 4 to 11 weeks in the United States and abroad. Local councils sponsor hiking, cycling, canoeing, and skiing trips for one day to four weeks.

Commenting on his hostelling experience, President Franklin D. Roosevelt, honorary president of the AYH in 1936, said: "I was brought up on this sort of thing and realize the need for hosteling. From the time I was 9 until I was 17, I spent most of my holidays bicycling on the Continent. This was the best education I ever had; far better than schools. The more one circulates in his travels, the better citizen he becomes, not only for his own country, but of the world."

National headquarters of American Youth Hostels, Inc., are in Washington, D.C. 20005. Hostel locations and specific information can be found in the *AYH Handbook*, which comes free with the AYH pass. The *International Handbook*, which may be purchased from AYH, contains information about the 5,000 hostels in the International Youth Hostel Federation.

THOMAS L. NEWMAN  
American Youth Hostels, Inc.

**YOUTHFUL OFFENDER**, the legal status granted in the United States to a young person, generally 16 to 19 years of age, who has committed a crime not punishable by death or life imprisonment and has not previously been convicted of a felony. Such a person, on application to the court, can be given the status of youthful offender. This ensures that all proceedings will be kept secret, the young person's name will be protected, and rehabilitation will be encouraged. The adjudication of the case is not legally considered a conviction.

**YPRES**, ē'prə, a town in Belgium, in West Flanders province, 30 miles (48 km) southwest of Bruges. In the Middle Ages, Ypres (Dutch, Ieper) was one of the most powerful and prosperous cities in Flanders, mainly because of its textile production, which remains its main industry and market. During the 13th and 14th centuries it must have had a population of 80,000, although a document by Pope Innocent IV, dated 1247, mentions 200,000. The city was repeatedly attacked, and a siege by the English in 1383, during the Hundred Years' War, put an end to its prosperity. Testimony to the former greatness of Ypres is the 13th century Halles (market), which is an impressive Gothic building partially destroyed in World War I and reconstructed. The Halles now houses a museum and city government offices.

Of the numerous patrician houses that Ypres once contained, only the Biebuyck House (16th century) remains. The Belle Hospital, now a museum, was built in the 13th century. St. Martin's Cathedral (13th century) and the medieval Butchers' House, now a municipal and war museum, have been reconstructed, as have many of the old houses in the center of the town.

Around Ypres are large cemeteries for Allied soldiers killed in World War I, and in the town itself the Menin Gate commemorates the British dead. During the war the Allies suffered 300,000 casualties in defense of the town; and in the Second Battle of Ypres (1915) the German Army used poison gas as a weapon for the first time. Population: (1980) 34,446.

**YPRES, Battles of**, *ē'prə*, three battles fought in or near the Belgian town of Ypres during World War I. In the first two battles (1914, 1915) the Allied forces held Ypres despite heavy attacks by the Germans. In the third (1917), a successful British offensive resulted in the capture of the village of Passchendaele. See also *WORLD WAR I—Concluding Operations of 1914; Operations in 1915; Operations in 1917*.

**YPSILANTI**, *ip-sə-lan'tē*, a city in southeastern Michigan, in Washtenaw county. It is situated on the Huron River, 30 miles (48 km) west-southwest of Detroit. A residential and industrial center, Ypsilanti manufactures automobiles and automotive parts, paper, ladders, plastics, and sheet-metal machinery. The plant at Willow Run, which now produces automatic transmissions, was famous during World War II as the production center for B-24 bombers. Willow Run Airport, serving the Detroit metropolitan area, has an aeronautical research center operated by the University of Michigan. The city is the home of Eastern Michigan University, which was founded in 1849 as Michigan State Normal School (later College), and Cleary College, established in 1883.

Ypsilanti was settled in its present location in 1823 and was named for the Greek patriot Gen. Demetrios Ypsilanti. It was incorporated as a village in 1832 and chartered as a city in 1858. The city has a council-manager form of government. Population: 24,846.

**YSAÏE**, *ē-zā-ē'*, **Eugène** (1858–1931), Belgian violinist. He was born in Liège on July 16, 1858. After studying the violin with his father, he entered the Liège Conservatory when he was seven. In 1868 he won a first prize in violin and chamber music. After further studies under Henryk Wieniawski and Henri Vieuxtemps, he began an international concert career, playing on the Continent and in Britain. In 1886 he organized the Ysaÿe Quartet, which became world famous. From 1886 to 1898 he also taught at the Brussels Conservatory.

In 1894, Ysaÿe played the Beethoven violin concerto with the New York Philharmonic Orchestra, the first of many American appearances. He also became active as a conductor. He formed the Société des Concerts Ysaÿe in Brussels and served as conductor of the Cincinnati (Ohio) Symphony Orchestra from 1918 to 1922. He died in Brussels on May 12, 1931.

Ysaÿe wrote numerous compositions, but they were not performed much. Among them is the opera *Piér li houïeu* (*Peter the Collier*), with a libretto in the Walloon dialect. Written after Ysaÿe's 70th year, it was first performed in Liège in 1931. In 1937, Queen Elizabeth of the Belgians instituted an international violin competition, with the prize named in Ysaÿe's honor. The first winner was David Oistrakh.

HERBERT WEINSTOCK  
Coauthor of "Men of Music"

**YSER RIVER**, *ē-zār'*, a river in northern France and western Belgium, about 48 miles (77 km) long. It rises northeast of St.-Omer, France, and flows into the North Sea 2 miles (3 km) below Newport (Nieuport), Belgium. In October 1914 the Allies halted the German offensive against the Channel ports by opening the dikes of the Yser and flooding the countryside.

**YTTERBIUM**, *i-tŭr'bē-əm* (symbol Yb), a scarce, soft, silver-colored metallic element with atomic number 70 and valence +2 or +3. Ytterbium is the next-to-last member of the rare-earth, or lanthanide, group. It was first identified as a distinct element in 1907 by Georges Urbain in France, and, independently and nearly simultaneously, by Carl Auer von Welsbach in Austria. The element is made up of 7 stable isotopes with mass numbers 168 and 170 through 175, and has an atomic weight of 173.04, a density of 6.997 grams per cubic centimeter, and a melting point of 824°C (1515°F). It is found in several minerals, including monazite, gadolinite, and xenotime, and forms a number of divalent and trivalent compounds, including the white oxide Yb<sub>2</sub>O<sub>3</sub> (ytterbia). Ytterbium is obtained by extraction from monazite and other minerals. See also *RARE EARTH*.

**YTTRIUM**, *it'rē-əm* (symbol Y), a grayish black trivalent metallic element with atomic number 39. Yttrium in nature is always found together with one or more of the rare-earth, or lanthanide, elements (those with atomic numbers 58 through 71), and aqueous solutions of its salts exhibit chemical properties closely similar to those exhibited by aqueous solutions of rare-earth salts; for these reasons yttrium often has been classified as a rare earth. Yttrium oxide (Y<sub>2</sub>O<sub>3</sub>, yttria) was discovered in 1794 by the Finnish chemist Johan Gadolin as a constituent of the mineral gadolinite, formerly called ytterbite because it was first found at Ytterby, Sweden. (The elements yttrium, erbium, terbium, and ytterbium are all named after this Swedish village.) Elemental yttrium was first obtained in a relatively pure form by the Swedish chemist Carl Gustav Mosander in 1843.

Yttrium has an atomic weight of 88.92, the stable isotope Y<sup>89</sup> making up 100% of the naturally occurring element. It has a density of 4.478 grams per cubic centimeter and a melting point of 1509°C (2748°F). The element has a crustal abundance of 28 parts per million, which ranks it somewhat below copper, nickel, and zinc, and slightly above lead and lithium. Yttrium-containing minerals include monazite, gadolinite, euxenite, xenotime, and samarskite. Yttrium is extracted commercially from monazite.

Yttrium is used mainly for making europium-activated phosphors for the color video screens used in television sets and computer monitors. In this application the phosphors give off a brilliant clean red light when excited by electrons. Yttrium-iron garnets (Y<sub>3</sub>Fe<sub>5</sub>O<sub>12</sub>) are used in some communications equipment because of their ability to transmit high-frequency energy with low losses. Yttrium is used in the metal industries as an alloying element and as a getter for removing impurities from other metals. Yttrium alloys are potentially valuable as nuclear-reactor moderators.

**YÜAN DYNASTY**, *yü-an'*, the line of Mongol rulers in China. The nomadic Mongols had already conquered most of the non-Chinese world known to them and had dominated part of China for more than 40 years when in 1271 the fourth khan of khans, Kublai or Khubilai (reigned 1260–1294), proclaimed a Chinese-style Yüan dynasty at Khanbalik (Peking). In 1279 his forces finally exterminated the native Sung dynasty in the south and made him the first foreign conqueror



to rule all China. Kublai's armies also attacked Japan (1274, 1281), Vietnam (1281-1287), Burma (1287), and Java (1292) without incorporating these areas into the Yüan domain.

The Mongols perpetuated China's traditional "Confucian" form of government, but they exploited, humiliated, and discriminated against the Chinese, who consequently have considered the Yüan era a dark age in their history. Yet it was a notable age in many ways. Cotton and sorghum were introduced into Chinese agriculture. Great advances took place in sea transport and naval warfare. There were also important Chinese writers and painters, and novels and dramatic operas emerged as new forms of popular literature. The Pax Mongolica (Mongol Peace) that spread from the Yellow Sea to the Mediterranean permitted Sino-Western exchanges of persons and influences as never before. The Venetian Marco Polo lived in China from 1275 to 1292 and subsequently wrote descriptions of its great cities, vast wealth, and other marvels that astonished generations of European readers. Among other notable European visitors in Yüan China was John of Montecorvino (Giovanni da Montecorvino), who reached Khanbalik in 1294 and served as Roman Catholic archbishop there from 1307 until his death in 1328.

Kublai Khan's 13 Mongol successors on the Chinese throne were not strong rulers, and from the 1320's onward Mongol groups feuded interminably with one another. Their neglect of governmental responsibilities, a long sequence of natural calamities, and the accumulated effects of inflationary issuances of paper money facilitated the rise of Chinese rebels in the 1350's and 1360's. One of these, Chu Yüan-chang, established the Ming dynasty in 1368.

CHARLES O. HUCKER,

*Author of "China: A Critical Bibliography"*

**YÜAN SHIH-K'AI**, yü-an' shir' kī' (1859-1916), Chinese military leader, who became the first president of the Republic of China. He was born in Siancheng, Honan province, and rose to prominence as the protégé of Li Hung-chang, who virtually dominated North China during the last decades of the 19th century. From about 1885, Yüan served as Li's agent in Korea, where his efforts to check the spread of Japanese influence provoked the Sino-Japanese War of 1894-1895. Although China suffered defeat, Yüan was protected by Li, who gave him the job of training troops in North China. Yüan armed his troops with modern weapons and introduced Western training techniques, with the result that his Peiyang or North Sea Army rapidly became the most powerful military force in China. Consequently, in 1898, when Chinese reformers led by Emperor Kuang Hsü plotted to seize control of the imperial government, they requested Yüan's assistance. Yüan probably exposed their plot to supporters of the Empress Dowager Tz'u Hsi, who routed the reformers and imprisoned the young emperor until his death in 1908.

When the xenophobic Boxer movement engulfed much of North China in 1900, Yüan won considerable support among foreigners by suppressing the insurgents in Shantung, where he had been appointed governor. Thereafter his power grew so quickly that in 1908 the dynasty dismissed him from his command, supposedly in order to avenge the dead Kuang Hsü, but in reality because the Manchus feared Yüan and

wished to reassert imperial control over his troops. Yüan, however, retained the loyalty of his army, which refused to defend the dynasty against the revolution of 1911 until he was reinstated. He persuaded the frightened Manchus to abdicate (Feb. 12, 1912), at the same time using his superior military power to overawe the revolutionaries, led by Sun Yat-sen. The result was a compromise, in the form of a republic with Yüan Shih-k'ai as its president (inaugurated March 10, 1912) agreeing to share power with a popularly elected legislature dominated by the followers of Sun Yat-sen.

In 1913, Sun's revolutionaries tried to overthrow Yüan's increasingly dictatorial regime but were defeated: in addition to possessing the most powerful army in China, Yüan enjoyed the support of foreign bankers, who in return were given a virtual stranglehold on much of China's economy. After destroying the republic, Yüan attempted to make himself emperor. He was frustrated by centrifugal forces generated in large part by his own policy of allowing his commanders to set themselves up as provincial warlords. Most were in rebellion against him at the time of his death in Peking on June 6, 1916.

DONALD G. GILLIN, *Vassar College*

**YUBA CITY**, yōō'ba, a city in north central California, the seat of Sutter county, on the Feather River, about 40 miles (64 km) north of Sacramento. Its name is derived from that of a Maidu Indian tribe that inhabited the area. A trade, shipping, and processing center for the surrounding agricultural region, which is noted for its peaches, prunes, and nuts, Yuba City has processing plants for feeds and nuts, fruit canneries, and packing plants for frozen fruits and vegetables. Beale Air Force Base is located 10 miles (16 km) to the east.

Yuba City was laid out in 1849 and incorporated in 1908. It has a council-manager form of government. Population: 27,437.

**YUCATÁN**, yōō-kā-tān', a state in Mexico, at the northern end of the Yucatan Peninsula, with a coastline on the Gulf of Mexico. The state has an area of 16,749 square miles (43,379 sq km) and a population (1980) of 1,063,733.

Except for a range of hills along the southwestern border, Yucatán consists of a sparsely inhabited plain formed of a chalky crustacean deposit. The meager topsoil is often covered by low trees and dense thickets. Rainfall, which is limited and occurs from May to September, seeps through the surface and is collected in underground rivers and in pools, from which it is raised by windmills for irrigation.

Outside of the Mérida-Progreso urban zone, most of the people are rural Maya. Some 40% of the state's population lives in Mérida, the capital, which was linked with Mexico City by rail only in 1950 and by highway only in 1961. Mérida is an important air junction. Progreso, the state's chief port, is 22 miles (35 km) north of the capital.

The chief source of wealth is henequen, from which sisal hemp is obtained. The most important industry is the manufacture of cordage, bags, shoes, hats, and other elaborations of sisal, a native product named for the small port of Sisal, west of Progreso. Sugar and maize are grown in Yucatán, and fishing is conducted off the coast. Good-quality honey, royal jelly, tropical fruits,



and beer also are produced. Tourism is a major source of income, and excellent hotels have been built at the site of the ancient Maya ruins of Chichén Itzá and Uxmal. Other archaeological sites include Mayapán, Yaxuná, Dzibilchaltún, Kabah, Sayil, and Labná.

IRENE NICHOLSON

Author of "Conquest of Mexico"

**YUCATAN PENINSULA**, yōō-kā-tan', a projection of the North American continent between the Gulf of Campeche on the west, the Gulf of Mexico on the north, and the Caribbean Sea on the east. Its area of about 70,000 square miles (180,000 sq km) comprises the Mexican states of Campeche, Yucatán, and Quintana Roo, part of Petén department in northern Guatemala, and all of Belize.

The extreme southerly portion of the peninsula rises to about 500 feet (150 meters) and is covered by tropical rain forest containing such commercially important trees as mahogany, ebony, red cedar, logwood, and the chicle-producing chicozapote (sapodilla). A chain of low hills, nowhere more than 300 feet (90 meters) in elevation, crosses from the city of Campeche to Chetumal Bay. The northern part of the peninsula is a dry, stony plain formed by crustacean deposits and subject to rising and sinking. This plain, drained mostly by underground rivers and caverns, supports mesquite, cactus, and the cultivated henequen (sisal), which is the major crop.

The population of the Yucatan Peninsula consists mainly of Maya, descendants of the peoples whose civilization flourished throughout this area long before the Spanish conquest. The civilization of the Classic Period was centered in the southern part of the peninsula between 300 and 800 A.D. Afterward, for reasons not entirely understood, the principal centers of habitation were moved northward to the cities of Chichén Itzá, Mayapán, and Uxmal, which are now important archaeological sites.

The first Europeans to land in Yucatan appear to have been two Spaniards shipwrecked in 1512, although some earlier maps that seem to show a distorted Yucatan coastline would put the peninsula's discovery before 1503. Francisco Fernández de Córdoba explored the coast in 1517 and was followed by Juan de Grijalva the next year. The period of conquest extended from 1519, when Hernán Cortés anchored off Cozumel Island, to 1540, when the Maya were finally subdued by the two Francisco Montejos, father and son. By 1542 the Spaniards had founded Mérida on the site of the Mayan city of T'ho. However, the Maya were not finally subdued until the beginning of the 20th century, by the Mexican government.

IRENE NICHOLSON

Author of "Conquest of Mexico"

**YUCCA**, yuk'a, a genus of trees and shrubs belonging to the agave family (Agavaceae) and characterized by stiff, evergreen, sword-shaped leaves crowded on a stout trunk. The white or greenish flowers are borne in a dense terminal panicle that faintly resembles a candle. This counts for the common name Our Lord's candle—frequently applied to *Yucca whipplei* of the southwestern desert areas of the United States.

Forty species of yucca exist, mostly confined to the arid portions of North America. Spanish



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*Yucca baccata*, commonly called Spanish bayonet, with the dense terminal flowerhead characteristic of yuccas.

bayonet, *Y. baccata*, and other species were a source of fiber for the construction of ropes, sandals, and cloth by the Indians. The roots containing saponin were a source of soap, while the green pods were cooked and eaten by both Indians and early Californians. The Joshua tree, *Y. brevifolia*, attains an average height of 20 to 30 feet (6–9 meters) and is common at the base of desert mountains, with 8 to 10 inches (20–25 cm) of rain, in southern California and adjacent states. A dense forest of these trees in the Mojave Desert was set aside as the Joshua Tree National Monument in 1936.

Yuccas are entirely dependent on various species of nocturnal moths (*Tegeticula*) for pollination of the flowers. Each variety of yucca moth is adapted to a single species of yucca. See also YUCCA MOTH.

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**YUCCA MOTH**, yuk'a, a moth of the genus *Tegeticula* belonging to the family Incurvariidae. Four species are known. The female gathers a ball of pollen from the stamens of one yucca flower with the help of specialized mouthparts. She then carries this ball to a second plant, and after depositing one or more eggs in the ovary with her long ovipositor, she climbs to the top of the pistil and packs the pollen ball into the depression formed by the stigma. The seeds will then mature, and some of them will serve as food for the moth larva.

The yucca plant seems to be absolutely dependent on the moth for this pollination. The larva, when fully grown, eats its way out of the seedpod and hibernates in or on the ground in a tough cocoon. In the spring the larva pupates, emerging as an adult during the blooming season of the yucca. See also YUCCA.

WILLIAM D. FIELD

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BILDARCHIV LENORE ANDER

Yugoslavia's capital, Belgrade, and its fortress of Kalemegdan mark the junction of the Danube and Sava rivers.

# YUGOSLAVIA

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**YUGOSLAVIA**, yoo-gō-slā'vĕ-ə, a country in south-eastern Europe, in the western half of the Balkan Peninsula. Excluding the Soviet Union, it is second in eastern Europe only to Poland in area and population. Created in 1918 as a centralized, unitary state, Yugoslavia in 1945 became a federation of six republics: Bosnia-Herzegovina, Croatia, Macedonia, Montenegro, Serbia, and Slovenia. The six "nations" (peoples) that these republics were created to represent speak three languages and profess three major religions. Yugoslavia also contains various "nationalities" (minorities), and it is bordered by seven foreign countries. These unusual circumstances of its national life created problems for Yugoslavia that were faced by few other sovereign states.

The complexity and diversity of Yugoslavia's situation can best be understood in the light of history. Ancient Greece had little contact with most of this mountainous area, although some Greek colonies were established along the coast and on the islands of southern Illyria, as the

region came to be called in the ancient world. Several centuries later Rome established a protectorate over the region following its two Illyrian wars, which were fought late in the 3d century B.C. in order to end the Illyrian threat to Roman shipping. In the next two centuries the hinterland of Illyria was brought under Roman control. During the imperial period Illyria served as a source of military manpower, and, in the late 3d century A.D., even of emperors. The emperors Claudius Gothicus, Aurelian, Probus, and Diocletian (whose palace at Split survives), were all of Illyrian origin.

The Roman Empire was divided into two halves, Western and Eastern, after the death of Theodosius the Great in 395 A.D. The lands to the east of a line that followed the Drina River, then cut across what is today eastern Bosnia and through the middle of present Montenegro, became part of the Eastern empire, the lands to

## INFORMATION HIGHLIGHTS

**Total Area** (land and inland water): 98,766 square miles (255,804 sq km).  
**Boundaries:** North, Austria and Hungary; east, Romania and Bulgaria; south, Greece and Albania; west, Adriatic Sea and Italy.  
**Elevations:** Highest—Triglav (9,394 feet, or 2,863 meters); lowest—sea level.  
**Population:** (1981 census) 22,424,687; (1990) 23,842,000.  
**Capital and Largest City:** Belgrade (Beograd).  
**Major Languages:** Serbo-Croatian, Slovene, and Macedonian (all official).  
**Major Religious Groups:** Eastern Orthodox Christians, Roman Catholics, and Muslims.  
 For Yugoslavia's flag, see under **FLAG**, both illustration and text.

the west of the line became part of the Western empire.

From the 3d century on, the Balkan Peninsula was raided repeatedly by barbarian tribes. Slavic invaders first appeared in the peninsula in the 6th century and in the next two centuries succeeded in establishing themselves there. These Slavs, known as South Slavs, were soon divided by geography and historical events. The Croats and Slovenes settled in the north of what became Yugoslavia, and the Serbs in the south. In time the Croats and Slovenes were oriented toward the West and were won to the Western form of Christianity. The Serbs fell under the influence of Byzantine culture and became part of Eastern, or Orthodox, Christianity.

The Serbs, Croats, and Bosnians (the area of Bosnia was settled by South Slavs beginning in the 7th century) all established kingdoms in the medieval period. But with the weakening of these states, the Ottoman Turks were able to win control over most of the region following their victory over the Balkan allied forces on the plain, or *polje*, of Kosovo in 1389. The Ottoman Empire left a lasting mark on the cultures and lives of the peoples under its domination. A large percentage of the Slavic population of Bosnia even converted to Islam.

Ultimately only a few areas in the region escaped Ottoman hegemony. One of these was Slovenia, which in the Middle Ages had become part of the German kingdom and then had passed to the Habsburgs in the late 13th century. Within the Habsburg empire the Slovenes formed 90% of the population of the Austrian province of Carniola and a significant proportion of Styria, Carinthia, and Görz (Gorizia) and Gradisca. Most of Croatia, united with Hungary through the person of a common monarch since 1102, fell to the Ottomans after the Turks had defeated the Hungarians at the Battle of Mohács in 1526. But northern Croatia, including Zagreb, passed in the next year under Habsburg rule.

At the end of the 17th century, the European powers began successfully to challenge the Ottoman control of Christian populations. The Habsburg monarchy, playing the leading role in the western Balkans, occupied most of the rest of Croatia and Slavonia up to the Sava River. The territory was formally ceded to the Habsburg empire by the Treaty of Karlowitz in 1699. Although the same treaty gave Dalmatia to Venice, Dalmatia ultimately passed to the Austrian Empire in 1815.

Serbian revolutionary action began with the outbreak of a revolt in 1804. Serbia first achieved autonomy; then, by a treaty that was concluded at the Congress of Berlin in 1878, it gained its independence. The Congress also negotiated the independence of the principality of Montenegro and granted Austria-Hungary the right to occupy and administer Bosnia and Herzegovina. The Dual Monarchy annexed those provinces in 1908. The part of Macedonia that eventually made up the Yugoslav republic of Macedonia was the last area of Yugoslavia to be separated from the Ottoman Empire. That event occurred in 1913, when Serbia received most of northern Macedonia by the Treaty of Bucharest, which ended the Second Balkan War.

In 1918 these various areas that once had formed part of the Ottoman and Austro-Hungarian empires were merged into the new Yugoslav ("South Slav") state. Yugoslavia also gained the

lands constituting Vojvodina from Hungary. But the present Yugoslav-Italian boundary was not achieved until after World War II.

The complex history of the Yugoslav region is reflected in the basic ethnic and cultural composition of the six republics. The Slovenes and Croats are Roman Catholics, and their system of writing is the Latin alphabet. On the other hand, the Serbs, Montenegrins, and Macedonians are Orthodox Christians, and their writing system is the Cyrillic alphabet. The population of Bosnia-Herzegovina is composed of Bosnian Muslims, who are recognized as a separate people, as well as of Serbs and Croats. Two autonomous provinces were created within Serbia: Kosovo in the south, because of its Albanian majority; and Vojvodina in the north, because of its mixed population reflecting the area's long association with the multinational monarchy of the Habsburgs.

From its birth in 1918, Yugoslavia has had to confront the problems posed by its own multinational composition. Its first government, a centralized regime under firm Serbian control, was not able to win the support of the other peoples; nor could it make significant headway in improving the economy of this impoverished land. The country's post-World War II Communist government sought to solve the multinational problem by decentralizing authority and making a major effort to reconcile the six major peoples and the minorities. At the same time, it tried to improve the economy by expanding and modernizing the industrial sector. The economic system that Yugoslavia's Communist leaders introduced differed from both that of the West and that of the Eastern-bloc countries. In foreign policy as well, Communist Yugoslavia avoided joining either of the Great Power blocs, led by the United States and the Soviet Union. Instead, it made efforts to build and maintain a nonaligned, neutral camp, composed chiefly of Asian and African countries.

Seeking to solve difficult problems in new ways, the Communist Yugoslav government allowed a great deal of experimentation and freedom of action. That characteristic distanced it from other Communist states.

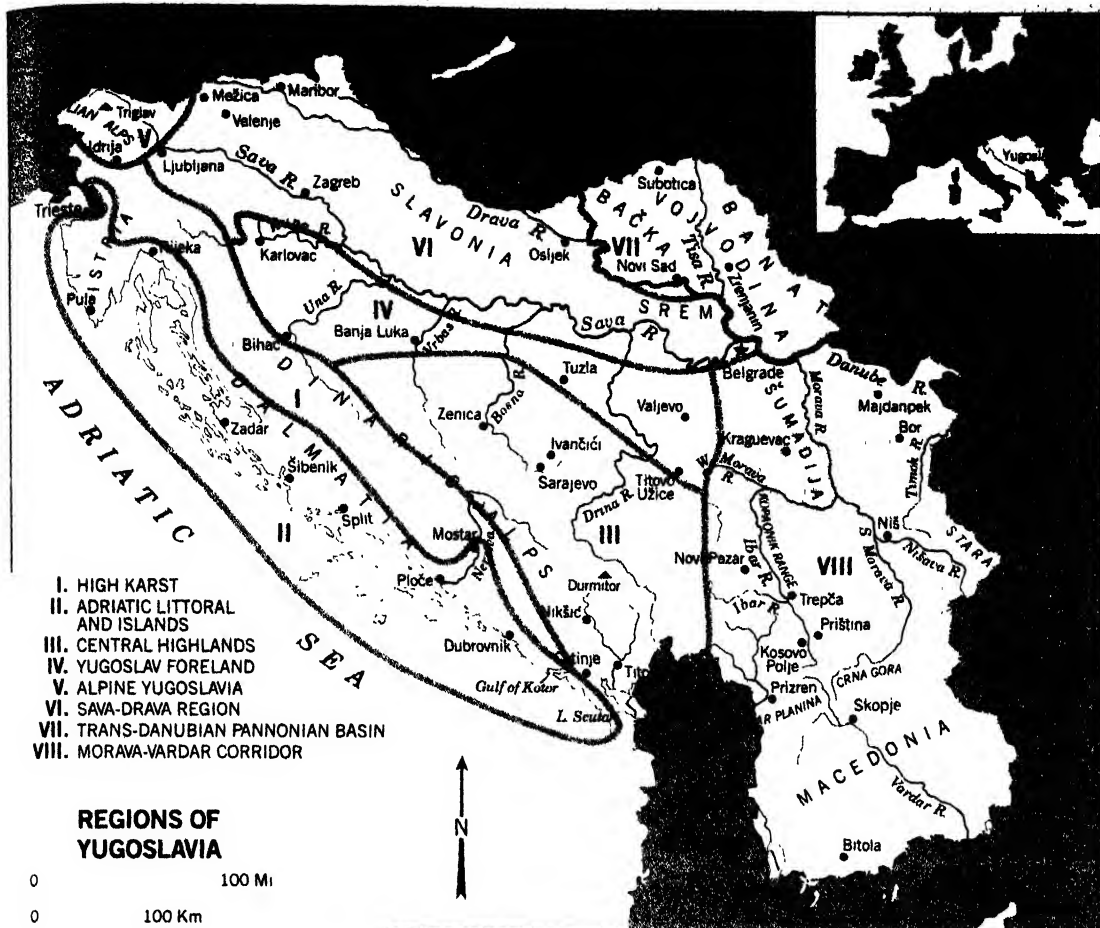
## GEOGRAPHY AND PEOPLE

### 1. The Land and Natural Resources

For a country of its size, Yugoslavia has a surprisingly varied terrain. In general terms the land can be divided into mountainous and high hilly regions, composing three quarters of the total area, and low hill country and plains.

The rugged mountainous areas have impeded communications among the peoples of Yugoslavia. They have perpetuated divisions among them and contributed to the spirit of isolation, separatism, and parochialism. In modern times they have acted as a barrier to the development of roads and railroads for the movement of goods, and have hindered the integration of the more inaccessible areas into the country's economy. It is true that the least accessible parts have served as places of refuge in times of trouble and have resisted conquest. But the lack of fertile soil and the alternation of droughts and floods in many of these harsh regions have not favored agricultural development.

Geological fault lines in the more mountain-



ous regions of the country and in the neighborhood of the Adriatic coast have caused severe earthquakes from time to time. In recent decades Skopje was virtually destroyed, in 1963, and had to be rebuilt. Banja Luka, in northern Bosnia, was devastated by an earthquake in 1969, and earthquakes along the southern Adriatic coast in 1979 did great damage.

**The Regions of Yugoslavia.** Dominating the physical map of Yugoslavia is the long stretch of the Dinaric Alps between the Julian Alps in Slovenia in the northwest and Albania in the south. This rugged limestone backbone consisting of both broad and narrow ridges and plateaus that are separated by basins and long valleys is the geographic "heartland" of Yugoslavia. Following the Adriatic coast, the Dinarics also fan out to a width of well over 100 miles (160 km) as they reach southward. They occupy about one quarter of Yugoslavia and average 4,000 to 6,000 feet (1,200–1,800 meters) in elevation.

The mountain chain, the axis of which parallels the coast, runs so close to the sea that it restricts the Adriatic littoral to no more than a narrow ribbon of land for most of its length and, lacking transverse valleys across the ranges, blocks the country's coast from the interior.

The High Karst plateau occupies the western section of the Dinarics. To the east and south-east of the High Karst are the Yugoslav Central Highlands. From the Highlands the land descends through the transitional zone of the Yugoslav Foreland to reach the Sava and Morava river basins.

The eastward-flowing Sava and Drava rivers rise in Alpine Yugoslavia in the northwest corner of the country and ultimately join the Danube River. To the north of the Danube River is the fertile Pannonian Basin, which Yugoslavia shares with Hungary and Romania.

Joining the Danube from the south is the Morava River, which with the southward-flowing Vardar River drains a large region embracing most of Serbia and Macedonia. Highlands on Yugoslavia's eastern borders are related to the major mountain systems of Romania and Bulgaria.

**The River Network.** Like the mountainous regions, the rivers have not served to unify the country because the three major river systems lead in opposite directions. The largest system, the Danubian, ultimately empties into the Black Sea. Most of Yugoslavia's rivers, draining about three quarters of the country, flow into this system. The Danube's major right-bank tributaries in Yugoslavia are the Drava, Sava, and Morava; its major left-bank tributary is the Tisa. The Sava and the Danube into which it flows have historically formed part of a major corridor between the Adriatic and the Black Sea, with access from the Adriatic to the headwaters of the Sava reached through Peartree Pass (Postojna) between Trieste and Ljubljana.

Yugoslavia's only major river emptying into the Adriatic is the Neretva, which cuts through the Dinaric Alps. And the region's outlet to the Aegean Sea is through the Vardar River, which rises in Macedonia and flows southeast through

southern Yugoslavia and Greece to discharge into the Aegean near Salonika. The corridor formed by the Vardar-Morava rivers has provided throughout the centuries the region's major route from the Aegean to the Pannonian Basin via the Danube.

In the lowlands associated with Yugoslavia's major river systems are found the densest population concentrations, the best agricultural lands, the most extensive transportation networks, and the greatest concentration of industry.

**Climate.** Yugoslavia's Adriatic coast and islands and southern Macedonia near the Aegean Sea have Mediterranean climates, with mild winters and hot summers. The January average is 45°F (7°C); the summer average is 75°F (24°C). At the other extreme the mountain areas have cold winters and short summers with cool temperatures. The other regions have a continental climate with cold winters and hot summers, averaging 30°F (-1°C) in winter and 75°F to 80°F (24°C-27°C) in summer.

Rainfall averages vary widely. The agricultural plains of the northeast receive an average of 25 to 40 inches (635-1,015 mm) and the coast from 25 to 30 inches (635-760 mm). Rainfall is particularly important for the Danubian plain, for a drought there can reduce crop yields dramatically. Macedonia has inadequate rain, and the Vardar Basin is the driest area in the country.

Yugoslavia's climate is also affected by its winds. The *bura* (hora) is a cold wind of great force that in winter descends on the Adriatic coast from the mountainous interior. The *sirocco*, crossing the Mediterranean from Africa, brings warm, moist air to the southern part of the coast, also in the winter. The *vardarac*, a cold wind blowing from the north, modifies Macedonia's winter temperature.

#### THE REGIONS

**The High Karst.** Its name derived from Slavic *kras*, and originally applied to a bleak, stony region in the hinterland of Trieste, the Karst of the Dinaric Alps is a region of rugged highlands and plateaus of parallel clefts and ridges. The High Karst, which forms the western part of the Dinaric range, extends for about 350 miles (565 km) from Slovenia in the north through western Croatia, western Bosnia, and Hercegovina. Its greatest width is no more than 50 miles (80 km). On its western flank it drops sharply to the plains along the Adriatic coast. It is breached by only one long river, the Neretva, which reaches the Adriatic through deep gorges. The river's rapid descent has been utilized for the production of hydroelectric power.

Composed of porous limestone, the karstic landscape is honeycombed with sinkholes and caves created by rain eroding the limestone, which is highly soluble in water. Subterranean rivers, fed by water seeping through the crevices in the limestone, run through underground channels in the dissolving limestone. Hollows are formed as the caves collapse with further dissolution of the calcareous rock. The smaller, rounder hollows are called *doline* and the larger, elongated ones *uvale* and *polja* (fields; singular, *polje*). The *polja*, typically surrounded by higher ground, can reach 50 miles (80 km) in length, though they are only a few miles wide.

Until the trees on the High Karst were felled centuries ago for shipbuilding among other purposes, these western flanks of the Dinarics were

well forested. Today the High Karst is an area of glaring white limestone. What soil exists consists of alluvial deposits washed down into the narrow valleys from the highlands when their forest cover was removed, and of thin layers of residual *terra rossa* (red earth) on the floors of the karstic depressions. The latter consists of the less soluble part of the limestone and is fairly fertile.

Subsistence farming is possible in those *polja* where the soil is sufficient and the conditions are generally favorable. But farming them is difficult because they tend to flood when snows melt on neighboring peaks or when rains are heavy, and when the water evaporates in the summer heat, the depressions often turn into dusty, cracked fields.

**The Adriatic Littoral and Offshore Islands.** Yugoslavia's heavily indented coastline, or littoral, is in most places confined by the Dinaric Alps to no more than a narrow zone of land. Paralleling the Dalmatian coast are many long, narrow islands, the summits of karstic limestone mountains that were submerged as waters rose in the postglacial "drowning" of the coast.

Since most of the rivers flowing down from the High Karst are subterranean, or surface for only brief stretches, the amount of silt that has accumulated on the coastal plains is limited. The one exception is the area around the Neretva, where the river's silt has created a substantial delta. The lack of arable soil and the climatic pattern restrict agricultural development. However, south of Split, wheat, grapes, figs, olives, citrus fruits, and almonds are grown. In northern Dalmatia the major crops are corn, tobacco, and market-garden produce.

Bauxite is mined at various places along the coast. Calcium rock, from which cement is made, is mined near Split and in Istria. The latter is also the source of quartzite sands, zinc, lead, and some coal.

There is some commercial fishing, but shipping activities are of more economic significance, even though access to the interior is hampered by the difficult terrain of the High Karst and its lack of transverse valleys. The best port is Rijeka (formerly Fiume), which is linked to Ljubljana and Zagreb by rail. Of lesser importance are Split, Šibenik at the mouth of the Krka River, Ploče on the Neretva's delta, and Dubrovnik's port of Gruž. The two naval bases on the Adriatic are at Istria's port of Pula and at the port of Tivat on the spacious Gulf of Kotor.

Shipbuilding, food processing, the working of minerals mined nearby, such as the processing of aluminum from bauxite, and the manufacture of products from both local and imported raw materials are the chief industries.

The government promotes tourism along the Dalmatian coast, building both improved highways and modern hotels. The area is famous for its spectacular scenery, for resorts like Opatija near Rijeka, and for its cities of historical interest: Dubrovnik (Ragusa), once a great trading republic; Split (Spalato), with Diocletian's palace; Zadar (Zara), Šibenik, Trogir, and Kotor, which, along with Split, reflect Venetian cultural influences.

**Central Highlands.** Extending over much of Bosnia, a small part of western Serbia, and Montenegro, these highlands are east and southeast of the High Karst. An area of irregular rugged plateaus, they reach their greatest heights in



Dalmatia's popular beaches, backed against the Dinarics, alternate with rocky headlands along the Adriatic coast.

Montenegro, whose massif Durmitor rises to 8,275 feet (2,522 meters); Mt. Lovćen, between Montenegro's former capital, Cetinje, and the Adriatic, reaches 5,738 feet (1,749 meters).

Although limestone karst dominates the Montenegro uplands, in the rest of the Central Highlands, it gives way to schists, serpentines, shales, and sandstones. Because these rocks, unlike limestone, are impermeable, river systems have developed above ground. Three major rivers, the Vrbas, the Bosna, and the Drina, rise in the Central Highlands, cutting their way across the grain of the highland folds on their descent to the Sava River. Their own tributaries, however, generally flow in valleys paralleling the axis of the folds. The Bosna and Neretva rivers form a natural corridor between the Sava River and the Adriatic Sea coast inasmuch as the headwaters of one can be reached from the other by the Ivan Pass, a route used by ancient Romans, the Ottomans, and by railway builders in modern times.

The only rivers in the highlands not forming part of the Sava drainage system are Montenegro's Morača and its tributary the Zeta, which rises near Nikšić. The two rivers join at Titograd, Montenegro's modern capital, and ultimately flow into Lake Scutari.

Unlike the High Karst, most of the highlands are thickly forested, giving rise—where the forests are accessible—to a substantial lumber industry. Stockbreeding has been traditional in the region's high pastures, at least where the impermeable rock assures an adequate surface water supply. Farming is conducted chiefly in the region's basins.

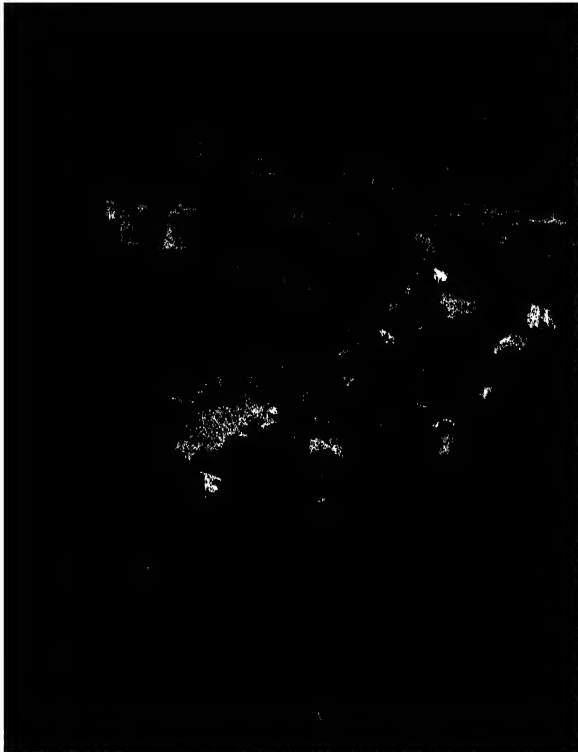
The Central Highlands are fairly rich in mineral resources, and over the years the government has located industries there near local resources in an attempt to upgrade the economy of this underdeveloped section of Yugoslavia. For

example, in the Sarajevo basin the iron-and-steel complexes at Zenica and Ivančici are based on iron ore mined in the area. Similarly, in Montenegro, steelworks have been developed in Nikšić, based on local iron ore.

**The Yugoslav Foreland.** An area of gently rolling land lying between the Central Highlands and the Sava River basin, the Yugoslav Foreland reaches from the Kupa River on the northwest to the Šumadija region south of Belgrade. This piedmont occupies a small part of Croatia, northern Bosnia, and the western part of central Serbia. The major tributaries of the Sava that rise in the High Karst and the Central Highlands—the Una, Vrbas, Bosna, and Drina—emerge from their deeply incised gorges to flow across the foreland before reaching the Sava.

Karlovac, the industrial center, is the chief Croatian city in the region. Banja Luka on the Vrbas and Tuzla near the Majevica massif are the region's two major Bosnian cities. A chemical industry has developed around the extensive salt deposits in the Tuzla Basin, aluminum is processed in nearby Zvornik from local bauxite deposits, and iron is mined in the vicinity of Ljubija in northwestern Bosnia. Valjevo, in a fruit-growing area, and Titovo Užice, the center of a stockraising and mining region, are the foreland's chief Serbian cities.

**Alpine Yugoslavia.** Two ranges of the Alps extend into Slovenia in the northwest corner of Yugoslavia: the Karawanken range, which straddles the Austrian frontier, and the rugged Julian Alps, which are shared by Italy and Yugoslavia. The ranges are separated by the northern arm of the Sava River, the Sava Dolinka. The Karawanken range reaches about 6,000 feet (1,800 meters), declining on the east toward the Drava Valley in the vicinity of Maribor. The highest peak in Yugoslavia is the three-headed limestone mountain Triglav (9,394 feet, or 2,863 meters) in



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The walled city of Dubrovnik (Ragusa) draws thousands of tourists each year in search of the city's proud past.

the Julian Alps. Southeast of Triglav is Lake Bohinj, the source of the other arm of the Sava, the Sava Bohinjka. The two branches of the river join at the resort lake of Bled near the Austrian border.

The thickly wooded hills and cultivated valleys of the region have the look of neighboring Austria. One of the country's oldest mercury mines is located at Idrija near the border with Italy.

**The Sava-Drava Region.** Emerging from Alpine Yugoslavia, the Sava on the south and the Drava on the north descend through the Slovenian hill country to the plains, ultimately converging on the Danube. Before leaving Slovenia, the Sava passes close to that republic's thriving capital, Ljubljana. Ljubljana's wealth and that of many other towns of Slovenia can be traced to the industrialization of the region, a development that was at least partially dependent on minerals that are extracted nearby: iron mined near Ljubljana, lead and zinc at Mežica, and lignite at Velenje.

Soon after entering Croatia, the Sava flows past Zagreb, the republic's capital and industrial center. The Sava and the approximately parallel course of the Drava to the north then enclose the plains of Slavonia. Farther to the east the Danube, which is joined by the Drava east of Osijek, and the Sava frame the region of Srem. These fertile alluvial plains form one of Yugoslavia's main agricultural areas. Remnants of the ancient Pannonian platform appear as outcrops and ranges, forming an interfluvial divide paralleling the river.

The region is Yugoslavia's main transportation corridor for both roads and railroads. This dense transportation network links the three major cities of Ljubljana, Zagreb, and Belgrade

(which lies at the eastern end of the region) and serves these and other important industrial cities along its route. Belgrade, at the confluence of the Sava and the Danube, is the capital of the country and of the republic of Serbia. It is also Yugoslavia's major manufacturing center and the hub of its communications network. Due to the region's natural advantages and historic importance, Yugoslavia's population is concentrated in the territory running generally from Zagreb to Belgrade.

**The Trans-Danubian Pannonian Basin.** The land of the Pannonian basin, lying to the east and north of the Danube River and comprising all of Vojvodina, is an extension of the Great Hungarian Plain, or Alföld. It is traversed from north to south by the Tisa (Hungarian, Tisza) River, a tributary of the Danube. The region known as the Bačka is to the west of the Tisa; the Yugoslav part of the Banat, to the east of the Tisa.

This region contains Yugoslavia's richest agricultural lands. It produces half the country's bread grains, half the corn, 85% of its sugar beets, and over 80% of its vegetable oils.

The fertile soil of the area includes rich alluvium deposited by rivers, loess borne by winds from the Alföld to the north, sediment from what were once lakes, and humus created by decaying grasses. In places where extensive sand dunes have developed in the drier areas, trees and grasses have established themselves. Marshlands in the floodplains have been drained to expand areas under cultivation and dikes built to check flooding. Canals are used for both barge traffic and irrigation.

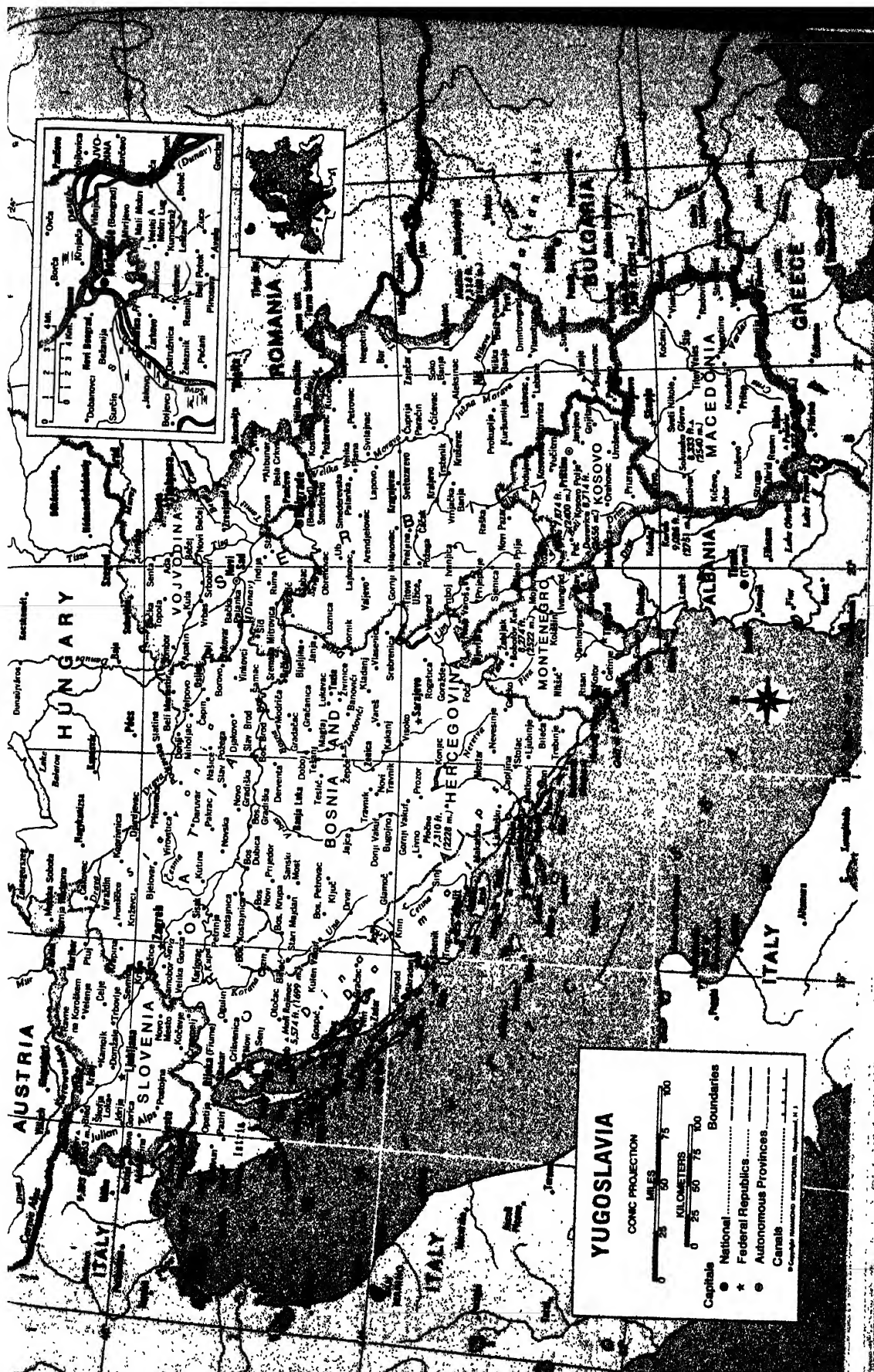
The processing of the agricultural products of the region and the manufacture of farm machinery are major industrial activities of the region's major cities—Novi Sad (the capital of Vojvodina), Subotica, and Zrenjanin.

Explorations beginning in the late 1950's also located substantial reserves of petroleum and natural gas in the Pannonian basin. When the fields were put into production, Novi Sad was made the center of production, and oil-related industries have been developed there.

**The Morava-Vardar Corridor.** The Morava River, formed by the junction of its two branches, the Western Morava and the Southern Morava, flows northward through central Serbia and discharges into the Danube east of Belgrade. The Vardar River flows southeastward through Yugoslav Macedonia before entering Greece on its way to the Aegean near Salonika. The Southern Morava and the Vardar rise only a few miles apart, near Skopje, Macedonia's capital, and their headwaters are separated by a relatively low watershed.

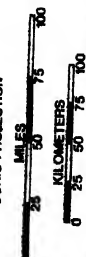
To the east of the Morava is an arc of mountains, part of the Balkan Mountain (Stara Planina) system. To the northeast, across the border in Romania, are the Transylvanian Alps. The Danube forces its way between these mountain systems in several narrow gorges. In 1972 a dam built by Yugoslavia and Romania was completed at the lowest defile, known as the Iron Gate. Copper is mined in the Balkan Mountain area near Majdanpek and Bor; Bor has one of the greatest copper reserves in Europe. Lignite is mined in the upper Timok Valley.

Just south of the curve of mountains as they enter Bulgaria is the city of Niš, standing athwart a natural corridor between Sofia, Bulgaria, and



## YUGOSLAVIA

CONIC PROJECTION



- Capitals
- National
  - \* Federal Republics
  - Autonomous Provinces
- Boundaries
- National
  - Federal Republics
  - Autonomous Provinces
  - Canals
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## INTERNAL DIVISIONS

Slovenia and Herzegovina	.....	C 2, D 3
Croatia	3,710,965	.....
Croatia (rep.)	4,366,387	8 2, C 2
Keovo (aut. prov.)	1,240,919	.....
Maccedonia (rep.)	1,823,568	E 3
Montenegro (rep.)	527,207	E 4, F 4
Serbia (rep.)	8,401,673	D 3
Slovenia (rep.)	1,987,068	B 2
Vojvodina (aut. prov.)	1,953,980	D 2, E 2

Adas 13,387	E 2
Alatnas 11,943	E 3
Apatin 17,501	D 2
Arundelkovec 15,659	E 7
Batja Palanka 21,314	D 2
Batja Topola 16,028	D 2
Benja Luka 85,786	C 2
Berodjici 5,531	D 2
Ber 3,594	D 3
Bosaj 28,616	E 2
Bula Crkva 11,137	E 2
Bula Palanka 5,861	F 3

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Čepin 7,567	D 2
Četinja 12,069	D 3
Črčevak 5,157	E 3
Čukarica 11,481.23	F 1
Čurinja 17,691	E 3
Čušj 6,330	D 2
Darugar 8,478	D 2
Debelo 6,597	E 4
Dečivo 5,129	F 4
Derventa 11,887	C 2
Dimitrograd 5,449	F 3
Djakovica 29,489	E 3
Đakovo 16,933	E 3
Đurđevac 6,334	C 1
Dobanovci 6,741	E 1
Đorđić 18,073	C 1
Domale 6,273	B 2
Đonji Mihaljević 5,214	D 2
Đonji Vekur 4,926	D 2
Dvăr 6,237	C 2
Dubrovnik 31,213	C 3
Fiume (Rijeka) 128,863	B 2
Gale 9,376	E 4
Gegelija 9,319	E 4
Glina 2,627	C 2
Gjiljane 21,359	E 3
Gorazde 9,563	D 3
Gornji Milanovac 11,114	D 2
Gornji Vakuf 24,229	C 3
Gospić 6,236	B 2
Gostivar 18,905	E 4
Gracë 3,226	B 2
Gradacica 9,302	D 2
Gradacac 7,571	D 2
Gusinja 2,686	D 3
Hercegov Novi 6,645	D 3
Hidra 15,574	B 1
Indija 18,004	D 2
Ivangrad 11,373	D 3
Ivanjica 5,719	E 3
Jazola 8,373	A 2
Jazeti 9,221	C 2
Janija 7,854	D 2
Jesenica 16,163	A 1
Jugoslavija 11,734	D 2
Kamnik 6,536	B 1
Kanjiza 11,348	E 1
Karlovac 47,046	B 2
Kavadar 17,974	E 4
Klevo 14,189	E 4
Klinda 37,392	E 2
Kladanj 3,255	D 2
Kladovo 6,655	F 2
Ključ 4,656	C 2
Kneževac 12,338	F 2
Knjazevac 11,734	F 3
Kodani 7,278	C 3
Kodani 16,611	F 4
Kosovje 7,277	B 2
Konjic 9,161	D 3
Kopar 16,863	A 2
Koprivnica 16,398	C 1

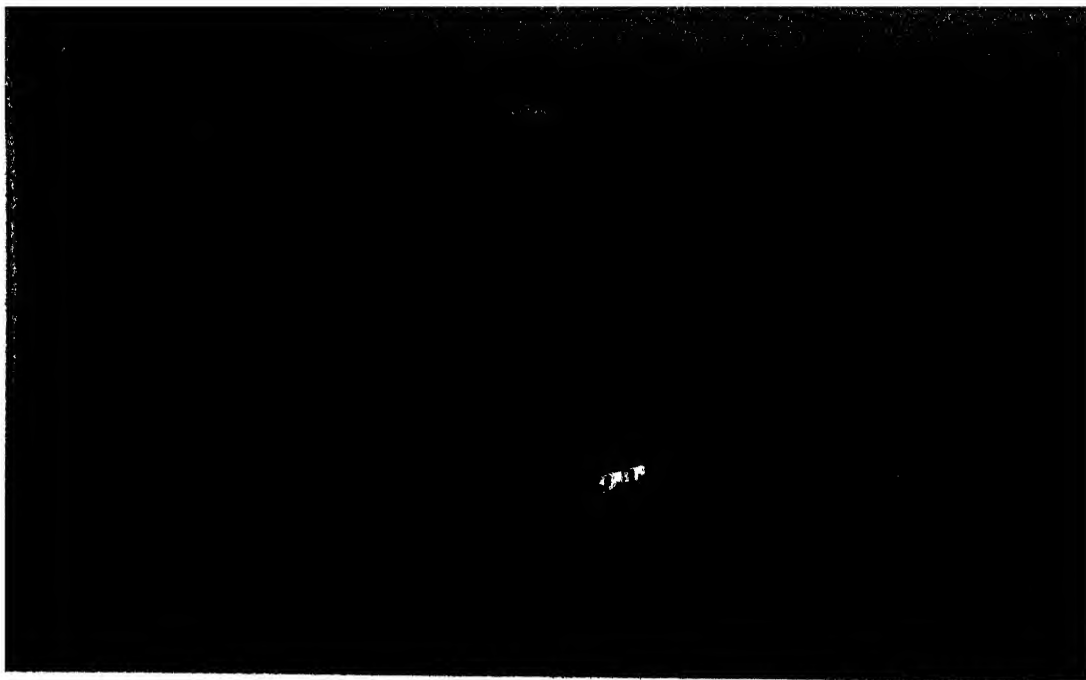
3	Kortula	2,694	C	3
4	Koosovo Polje	6,961	E	3
5	Kosovska Mitrovica	42,526	E	3
6	Kostanjica	2,434	C	2
7	Kostolac	8,409	E	2
8	Kotar	5,728	D	3
9	Kragujevac	72,080	E	2
10	Kraljevo	28,065	E	3
11	Kranj	26,341	B	1
12	Križevci	8,501	C	1
13	Krk	1,500	B	1
14	Krnjaka	11,228	F	1
15	Krško	4,451	B	2
16	Krusevac	29,902	E	3
17	Krušovo	4,488	E	4
18	Kućavo	4,524	E	4
19	Kula	17,194	D	2
20	Kumanovo	44,791	E	3
21	Kumodraž	8,557	F	2
22	Kurumlija	7,546	E	3
23	Kutina	10,892	C	2
24	Lapovo	8,144	E	2
25	Leposavi	5,886	E	3
26	Leskovac	46,050	E	2
27	Letkane	1,484	F	2
28	Lino	7,273	D	3
29	Ljubija	765	D	3
30	Ljubina	169,064	B	2
31	Ljubuški	2,991	C	3
32	Ljuznica	33,513	D	2
33	Lukavec	8,616	D	2
34	Majplj	5,969	D	2
35	Majdanpek	1,102	F	2
36	Makarska	6,969	C	3
37	Mal Miroti Lug	10,276	F	2
38	Maribor	94,978	B	1
39	Meditovci	7,191	C	3
40	Mirijevci	7,635	F	2
41	Moldiča	7,406	D	2
42	Mostar	47,821	C	3
43	Murska Sobota	9,665	C	1
44	Nasice	5,836	C	2
45	Negotin	11,325	F	2
46	Negotino	6,916	F	4
47	Nevessine	3,077	D	3
48	Nikšić	28,940	D	3
49	Nin	1,782	B	1
50	Niš	128,231	E	3
51	Niška Banja	5,465	F	3
52	Nova Gorica	11,409	A	2
53	Nova Gradiska	111,765	C	2
54	Nova Gradiška	111,765	D	3
55	Nova Gorica	5,700	E	2
56	Novi Bečej	15,851	E	1
57	Novi Beograd	188,715	F	1
58	Novi Pazar	28,696	E	3
59	Novi Sad	143,591	E	3
60	Novi Travnik	6,397	C	2
61	Novo Mesto	9,553	C	2
62	Novska	5,168	D	2
63	Obrenovac	13,091	C	2
64	Ogulin	9,975	E	4
65	Ohrid	25,352	E	4

Smederevska Palanka	13,037	2
Soko Banja	5,546	3
Sombor	44,210	3
Spiti	150,739	3
Srebrenica	14,054	2
Sremstka Mitrovica	32,569	2
Srpska Pazova	13,886	2
Starčvo	6,540	1
Staro Majdan	1,568	2
Stop 27,18		4
Stok	3,882	3
Son 407		3
Struga	11,369	4
Strumica	22,770	4
Subotica	89,478	1
Sutrin	10,550	1
Surdulica	7,048	3
Sveti Nikole	7,391	4
Svetozarevo	27,812	3
Sviljanje	7,848	2
Tesani	3,862	2
Tesit	4,940	2
Tetovo	35,293	3
Titograd	54,639	3
Titovo Vace	35,465	2
Trovo Voles	35,583	4
Travnik	12,745	2
Trbovlje	16,293	1
Trbešnje	3,553	3
Trigrir	6,182	3
Trisankir	1,167	3
Trška	4,435	1
Tuzla	53,838	2
Ulcinj	7,472	4
Umanec	22,763	3
Valjevo	76,565	2
Vajpovo	6,568	2
Varduzim	34,682	1
Vares	7,632	2
Velenje	11,225	2
Velika Gorica	7,896	1
Velika Plana	12,684	2
Veliki Moki Lug	6,574	1
Vinkovci	5,908	4
Vinkovci	29,257	2
Virovitica	16,369	2
Vitegrad	4,753	3
Vladica	5,356	3
Vrasto	9,365	2
Vrsatice	8,923	3
Vojlovica	7,185	1
Vranje	25,909	1
Vrba	22,502	2
Vrbanja Banja	6,586	2
Vrška	33,573	3
Vučit	11,701	1
Wutover	29,500	2
Zadar	43,588	2
Zagreb	561,773	3
Zajeac	27,724	3

Zabovno 20,742	F 2
Zavidovič 6,891	F 2
Zelenik 15,689	F 2
Zarnun 13,557	D 2
Zanka 49,522	C 2
Zapce 3,177	C 2
Zavince 5,405	D 2
Zvonitja 6,498	D 2
OTHER FEATURES	
Bobotov Kuk (mt.)	D 3
Bošina (riv.)	D 2
Bošac (isl.) 12,915	C 3
Cesma (riv.)	B 2
Ces (isl.) 3,498	B 2
Dalmatija (reg.)	C 3
Danubije (riv.)	E 2
Dinaric Alps (mts.)	B 2, C 3
Drača (riv.)	C 2
Drina (riv.)	D 2
Đurđ Otok (isl.) 3,892	B 2
Duvno (Danube) (riv.)	D 2
Dunav (Danube) (riv.)	C 3
Đurđevik (isl.) 12,118	C 3
Ibar (riv.)	E 2
Ison Gata (gorge)	F 3
Isonzo (riv.)	E 2
Isonzo (riv.)	A 1
Isotica (riv.)	C 2
Julian Alps (mts.)	A 2
Kamenjak (caper)	E 4
Korab (mt.)	C 3
Korčula (isl.) 18,068	B 2
Konik (isl.)	C 3
Krka (isl.) 13,255	C 3
Lastovo (isl.) 1,188	C 3
Lim (riv.)	B 2
Ludj (isl.) 5,798	B 2
Miljet (isl.) 1,153	C 2
Morava (riv.)	E 2
Mura (riv.)	B 1
Neretva (riv.)	D 3
Ohrid (lake)	E 4
Pag (isl.) 8,011	B 2
Palafraga (isl.)	C 3
Prepe (lake)	E 4
Rab (isl.) 7,833	B 2
Ruen (Rupen) (mt.)	F 3
Sava (riv.)	D 2
Scutari (lake)	D 2
Sevonia (reg.)	D 3
Soča (isl.) 2,078	C 3
Solunski Glava (mt.)	E 4
Tara (riv.)	D 3
Timok (riv.)	F 2
Tisza (riv.)	F 2
Una (riv.)	F 2
Vardar (riv.)	F 2
Vib (riv.) 4,862	F 2
Vrba (riv.)	C 3

## OTHER FEATURES

Babovce	Kuh (mt.)
Bardejov	(riv)
Baz	(val) 72,915
Bela	(riv) 68,168
Cer	(val) 13,436
Dalmatka	(reg.)
Danubus	(reg.)
Dinaric Alps	(mtns.)
Draha	(riv)
Drava	(riv)
Dugi Otok	(isl.) 3,262
Dunaj	(Danube) (riv.)
Hvar	(isl.) 12,118
Iber	(riv.)
Jon Gate	(gorge)
Karavankas	(mtns.)
Karniola	(prov.)
Julian Alps	(mtns.)
Kampania	(capr.)
Korab	(mt.)
Korfuta	(isl.) 18,068
Kornati	(isl.)
Lad	(sl.) 13,255
Leik	(isl.) 1,186
Lind	(riv.)
Lofing	(isl.) 5,786
Milet	(isl.) 1,153
Mozzica	(riv.)
Mura	(riv.)
Nemets	(riv.)
Ochrid	(lake)
Pag	(isl.) 8,011
Palestrina	(isl.)
Prespa	(lake)
Rab	(isl.) 7,233
Ruan	(Ruijien) (mt.)
Sani	(riv.)
Sanzari	(lake)
Slovenia	(reg.)
Solta	(isl.) 2,078
Solumaka	Gleane (mt.)
Tara	(riv.)
Timok	(riv.)
Tiss	(riv.)
Vardar	(riv.)
Vesles	(riv.)
Vibos	(riv.) 4,262



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A Catholic church set in the rich, undulating hills of Slovenia recalls that republic's religious heritage.

the Morava Valley. Used in the past by migrating peoples and invaders moving between Anatolia and the Danube, this route is now followed by a major rail line between Istanbul and Belgrade.

Niš is located on the Nišava, a tributary of the Southern Morava. It is this southern branch of the Morava that forms the main corridor with the Vardar.

The region to the west of the Morava and extending south from Belgrade is known as Sumadija. In the early 19th century, Sumadija and its principal town, Kragujevac, was the center of Serbian nationalism. Sumadija is almost as densely populated as the Morava Valley region between Belgrade and the basin of Niš. These fertile areas, hot in the summer, are generally planted with corn and wheat. They are particularly famous for their plums and plum brandy (*sljivovica*). The whole of the Morava Valley is also being industrialized, and the location of industries is determined in part by the region's mineral resources.

The Sumadija is bounded on the south by the Western Morava. The Western Morava's major tributary, the Ibar River, joins it from the south, after flowing between the Kopaonik massif on the east and the Raška district (the core of the medieval state of the Nemanja dynasty) and its chief town, Novi Pazar, on the west. Further upstream on the Ibar, at the southern foot of the Kopaonik massif, is Yugoslavia's largest lead mine at Trepča.

The Ibar rises in the Mokra Planina, which forms the northwest boundary of the largely Albanian-settled area known as Kosovo. There are two major basins in Kosovo: the *polje* of Kosovo near Priština and that of Metohija near Prizren. The Kosovo *polje*, which provides an alternative Vardar-Morava route between the Aegean and Belgrade by linking the two river valleys via the Ibar and the Western Morava, was the setting for two great Ottoman victories (1389 and 1448).

The boundary between Kosovo and Macedonia is marked by two massifs, the Šar Planina and the Crna Gora. But Yugoslav Macedonia's most rugged terrain and highest mountains are found near its border with Bulgaria on the east and Albania on the west. The major basins in the republic are those of Skopje, Tetovo, to the west of Skopje, and Bitola in the south. Lakes have formed in the basins of Prespa on the border with Greece and Albania, and Ohrid on the border with Albania.

The Vardar River begins its southeastward course at Skopje, cutting its way through the crystalline rock in deep valleys. The land it drains receives less rain than central Serbia, and irrigation is necessary for the cultivation of rice, cotton, and tobacco. Grapes, figs, and almonds are grown in the more Mediterranean areas of the southeastern section of the republic. But agricultural possibilities have been limited because of widespread erosion that has resulted from earlier clearing of the forests and overgrazing.

The mineral resources of Macedonia include lead and zinc in the northeast, chromium in the north near Skopje, and iron ore in the west central part. Iron and steel, metallurgical, chemical, engineering, and textile industries are concentrated in the Skopje basin. The building of iron and steel plants in the region of Skopje is an example of modern attempts to disperse industry to poorer areas.

## 2. The People

After its birth as a multinational state in 1918, Yugoslavia had to confront conflicts and antagonisms among its constituent national groups. And after World War II the people themselves were changed in fundamental ways as a result of the rapid industrialization and urbanization of the country. In addition, the structure of Yugoslav society was profoundly altered by the replacement of the monarchy with a one-party Communist state.



**National Diversity.** A federation of peoples, Yugoslavia contains no "Yugoslav nation" as such, although it is possible to declare oneself a Yugoslav in the census. The country defines national identity by language, religion, ethnic affiliation, and history.

The state recognizes six major "nations," or peoples, of Yugoslavia—Bosnian Muslims (9% of the total population), Croats (20%), Macedonians (6%), Montenegrins (2.5%), Serbs (36%), and Slovenes (8%). These are all South Slavs. The "nationalities," or minorities, of Yugoslavia consist of Albanians, Bulgarians, Czechs, Hungarians, Italians, Romanians, Ruthenians, Slovaks, and Turks, all of whom enjoy certain recognized national rights. There are also Austrians, Germans, Greeks, Gypsies, Jews, Poles, Russians, Ukrainians, and Vlachs in Yugoslavia.

When established in 1918, the first Yugoslav state was called the Kingdom of the Serbs, Croats, and Slovenes, with only these three peoples receiving full recognition. The inhabitants of Macedonia were treated as Serbs, as were, with greater justice, the Montenegrins.

The Serbs have played the leading political role in Yugoslavia but one that often has been bitterly contested by the other peoples. The Serbs have a strong historical tradition of independent existence. In the 12th to 14th centuries, before succumbing to the Ottomans, they had a powerful kingdom that controlled large areas of the Balkans. Falling under Ottoman hegemony after the Battle of Kosovo in 1389, they were ruled through the Orthodox Church and by their own notables. During the Ottoman period many Serbs emigrated to lands in the Habsburg empire. Thus, by 1918 the Serbs formed a portion of the population of Dalmatia, Croatia, Slavonia, and of the lands that later were to constitute Vojvodina.

The Croats have a similar history of autonomous or independent existence. Living mostly in Croatia, Dalmatia, and Slavonia, they orga-

nized an independent kingdom in the 9th century. Joined with Hungary from 1102 until 1526, when Hungary was crushed by the Ottoman armies, the Croatian kingdom subsequently came under Habsburg rule.

The national development of the Slovenes occurred within the Habsburg empire. A prosperous peasant people, they had a generally higher standard of living than other South Slavs. Their language, not readily intelligible to Serbo-Croatian speakers, separated them from that majority of Yugoslavs.

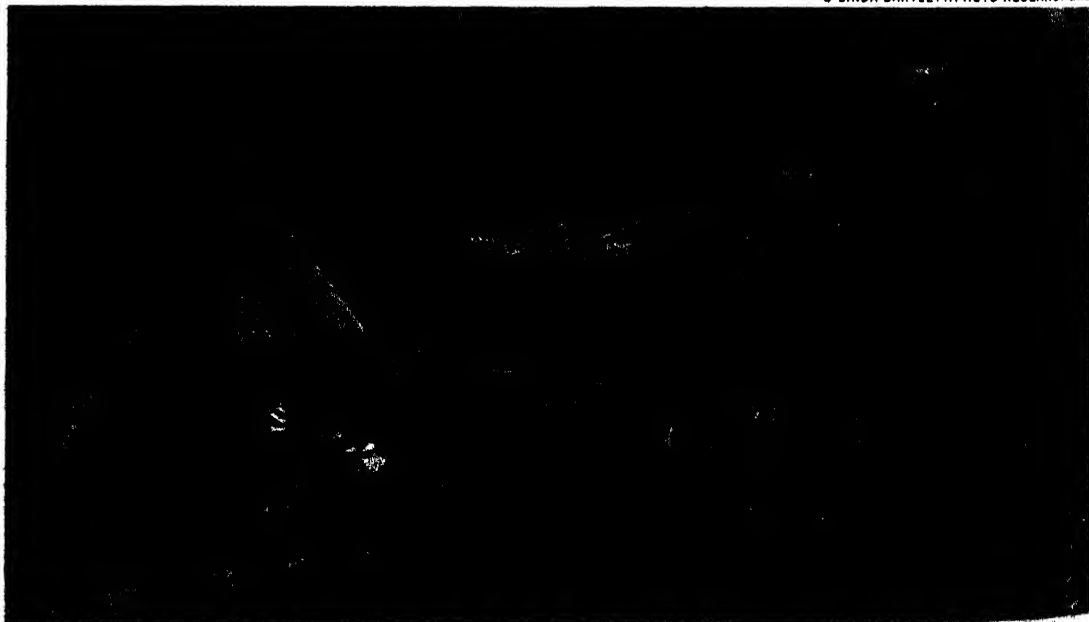
Whereas the first Yugoslav government based its political structure on these three peoples, the postwar Communist government recognized the unique historical and national characteristics of five other groups—in Bosnia-Herzegovina, Macedonia, Montenegro, Kosovo, and Vojvodina. Of these, Bosnia-Herzegovina is the most complex area. Although inhabited by Serbo-Croatian-speaking South Slavs, the republic is divided on religious and cultural grounds. Bosnian Muslims, considered a separate "nation" after 1945, form about 40% of the population of the republic; Serbian Orthodox, over 30%, and Croatian Catholics, nearly 20%.

Macedonia, which the interwar government had attempted to treat as Serbian, was organized on its own national basis in 1945. Contesting the control of the area with Bulgaria, the Yugoslav government recognized a separate Macedonian language, which became standardized, and attempted to define a Macedonian historical and literary tradition apart from that of either Serbia or Bulgaria.

Although Montenegro also had been regarded as Serbian, the Montenegrin population was recognized as a separate "nation" in 1945. The Montenegrins had retained a consciousness of their distinctive political identity, based on their history and their existence in an independent state after 1878. Their special status was also related to Montenegro's importance as a center of

A summer sheep camp nestles in the Durmitor range, the highest point in the harsh, karstic terrain of Montenegro.

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The Turkish bridge (1566) and minarets in Mostar are reminders of Hercegovina's Ottoman heritage.

resistance to Italy and Germany during World War II and to its role in the Communists' victory during the civil war after the Axis occupation.

The two autonomous regions of Serbia were created after World War II as a means of dealing with the problems associated with the Hungarian and Albanian minorities in Serbia. Of more than 20 ethnic groups living in Vojvodina, Serbs form a slight majority of the population; Hungarians, nearly 20%; and Croats, Slovaks, Romanians, Montenegrins, and Ruthenes, each between 6% and 1%. To deal with the area's multinational complexity, and especially to meet Hungarian grievances, five languages were recognized—Serbo-Croatian, Hungarian, Slovak, Romanian, and Ruthenian. These became the languages of major journals and newspapers, of radio and television stations, and of schools for classroom instruction. Although conflicts did occur, the linguistic policy in Vojvodina was generally considered a success.

Matters were quite different in Kosovo. There, Albanians—a Muslim group with the highest birthrate in Yugoslavia—form about 90% of the population. Most of the rest of the inhabitants are Serbs or Montenegrins. The majority of Yugoslav Albanians live in Kosovo, but some reside in Macedonia and Montenegro. Since many have been attracted to neighboring Albania, a state that in most of the postwar period was strongly opposed to Yugoslavia, the problem of the Albanian minority has been a matter of serious concern for the Yugoslav government.

Although great efforts were made to deal with ethnic antagonisms through the organization of the republics and the recognition of national rights, basic cleavages remained. The religious and cultural traditions of the Croats and Slovenes

differ from those of the Serbs, Montenegrins, and Macedonians. The Muslims in Bosnia-Herzegovina, Macedonia, and Kosovo have yet another religious and cultural orientation. It should be noted that among the Muslims only Serbo-Croatian-speaking Bosnian Muslims, not Albanian or other Muslims, were recognized as a separate people. In addition, past events had caused distrust between certain groups, in particular the Serbs and the Croats. A further disturbing factor was the extreme contrast in economic development between the poor, underdeveloped republics of Macedonia, Montenegro, and Bosnia-Herzegovina and the relatively prosperous republics of Slovenia and Croatia. After 1945, national passions and jealousies continued to play a major role in Yugoslav life, with each national group asserting its rights.

The problems associated with national diversity and a heritage of historic antagonisms were recognized by the postwar Communist government. Even though in Marxist doctrine nationalism was a passing historical phase, Socialist theory called for an initial period of national self-expression. Therefore, although the government emphasized socialism as the chief unifying force, it also acknowledged the many positive values of nationalism. Throughout the country the various peoples and minorities had their own newspapers, societies, theaters, orchestras, and, usually, the opportunity for education in their own language and for jobs in which their language could be used. But when the government deemed a nationalist manifestation to be a danger to the unity of the country or to control by the Communist party, it intervened. Such was the case with national demonstrations by the majority group in Serbia in the late 1960s, in Cro-

attia the early 1970s, and in Kosovo in the 1980s.

**National Integration.** During the period following World War II, forces for unity were strengthened at the expense of those for diversity by way of the modernization of the economy and the increasing movement of people within the country and in travel abroad. Before 1945 the regions of Yugoslavia, particularly in the rural areas, differed in dress, cooking, and manner of life. Afterward, although contrasts remained, urbanization, modernization, and industrialization leveled the way the majority lived and worked. Communist economic planning meant standardization in clothing, furniture, and housing. The new housing for the urban working population reflected styles found throughout the industrial world in the familiar pattern of massive block buildings and congested suburbs. Some attention was given to the preservation of historic buildings, both to maintain national heritages and to attract tourists, but a growing uniformity of appearance became apparent.

A large section of the population also either traveled or worked abroad and thus was well aware of cultural change and fashions in the rest of the world. The young in particular were taken by Western styles, especially in clothes and pop music. Thus, blue jeans and rock music, not peasant costumes and traditional songs, characterized the tastes of the rising generation. In addition, theater, domestic and foreign movies, and, in particular, television promoted uniformity and similarity.

**Social Structure.** From 1918 until after World War II, the Yugoslav state had a predominantly agricultural population: 79% of the total in 1921, 75% in 1938. Even though new industrial enterprises were established in the interwar period, the basic nature of the agrarian state was not changed. After 1945, as the Communist leadership devoted its energies to rapid industrialization, the agricultural sector was neglected. Yugoslavia underwent a social revolution marked

by a sharp decline in the strength and influence of farming. Whereas the agricultural population in 1945 was still more than 70% of the total Yugoslavian population, this figure had plummeted to 29% by 1980.

In the interwar years the state was controlled by a small group that was closely associated with the royal court, with business, or with the army, or who were among the wealthier members of the business community and the professions. The dictatorial nature of the regimes in power excluded the great majority of workers and peasants of all national groups from participation in the political life of the country.

Marxist theory, on the other hand, promised a classless society—but at some time in the future. The Communist government, while effectively excluding those who enjoyed economic and political power before 1945, created its own hierarchy of social and political influence. At the same time, though, it greatly widened and increased the numbers of active and direct participants in the governing of the country.

The new social stratification within Yugoslavia reflected the political realities of Communist Party rule and the economic hierarchy. At the top could be found a small minority who held the major administrative positions in the state, the party, and the chief economic enterprises. The most important decisions in political and economic life were made by them. They enjoyed special privileges and a high standard of living. Below this group but still in the upper ranks were those who held lesser positions in the same areas. Also with high status was a professional middle class of doctors, lawyers, engineers, teachers, and others, some employed in state enterprises and some having private offices. Next on the scale were the skilled workers and the successful farmers, and below them were the unskilled workers. As before, the lowest position of all was occupied by the peasants and agricultural laborers.

**Social Welfare.** The Communist Party program called for the creation of a society of equal citizens provided with basic social services. Differences in income were indeed often considerable, but certain benefits were guaranteed to all. Each citizen was given health, disability, and unemployment insurance, and was also guaranteed a pension. This program was administered by the republics and by local administrations. Employees' wages, hours, and vacations were set by the enterprises or institutions for which they worked. Under the principles of workers' self-management, the individual was meant to play some part in making the decisions connected with such matters.

Although each citizen did enjoy these social benefits, criticism was leveled at many parts of the program. Among the major defects singled out were the low level of retirement benefits and the poor quality of health care in public institutions.

**Population Changes.** Yugoslavia's population decreased dramatically in the 1940s as a result of enormous wartime losses, estimated at between 2 million and 3.25 million. Immediately after the war the population total was further reduced when members of certain groups—including Germans, Austrians, Italians, and Turks—were compelled to emigrate because of their wartime activities. Afterward, however, the population showed a marked rise.

Orthodox nuns stroll in their garden in Novi Sad, once an important center of Serbian Orthodoxy in Vojvodina.

© DR. HANS KRAMARZ



Such groups as this national youth brigade drew together Yugoslavs from all of the republics.

The improved health services introduced by the Communist regime caused a conspicuous drop in the mortality rate, but the birthrate fell even more rapidly. The result was a declining rate of natural increase, from an average of 2.8% a year in 1948–1953 to 0.9% a year in 1971–1981. Natural increase, varying widely among the republics and national groups, was lowest in economically advanced areas such as Slovenia and Croatia, and highest in impoverished areas such as Kosovo and Macedonia. Considerable attention was paid to the relative numerical strength of the national groups. Thus the 24% population increase for Kosovo between the 1971 and 1981 censuses had strong political repercussions.

Postwar Yugoslavia was characterized by large movements both within the country and to other countries. The most important internal migration was the shift from the countryside to the cities. In addition, workers from the poorer sections of the country migrated to the richer areas—for example, from Bosnia-Herzegovina to Slovenia and Croatia. Usually without specialized training, they were hired chiefly as unskilled labor.

Most of the emigrants from Yugoslavia left to work in the expanding and prosperous industrial areas of Western Europe, in particular West Germany. Unlike previous emigrations, this new wave came for the most part from the wealthier republics and was composed of skilled and highly motivated workers or professionals, who sought economic and social advancement. But, except for those who emigrated permanently, many of the workers who had left the country began to return in the late 1970s as worldwide recession forced a general economic contraction in all the host countries.

### 3. Education

The regions that were joined together in a unitary state in 1918 varied widely in the extent and quality of their educational systems. A major problem for the new country was the degree of illiteracy, more than 51% in 1921. Regional

differences were most apparent: only 9% of the Slovenes were illiterate, contrasted with 84% of the Macedonians. The interwar government made an effort to correct this state of affairs and also to provide better schools for the country. In 1940, nevertheless, the overall illiteracy rate was still about 40%.

Recognizing the vital importance of an educated population for a modern industrialized society, the government after 1945 attempted to improve matters. Education was made compulsory for eight years, for children between the ages of 7 and 15. For older students, various institutions of secondary education became available, including technical schools, teacher training schools, and classical gymnasias with studies designed to prepare students for entrance to a university. The major universities came to be those in the republican and provincial capitals—Belgrade, Zagreb, Ljubljana, Sarajevo, Skopje, Titograd, Novi Sad, and Priština. In 1950 the administration of educational institutions was decentralized.

Despite major efforts at raising the educational level, 15% of the population was still illiterate in 1971. The rate of illiteracy ranged from 1% in Slovenia to 32% in Kosovo. Adult-education programs were developed to spread reading ability and to teach additional skills to workers. By the 1981 census, illiteracy had declined to 9.5%.

A characteristic of the Yugoslav system was the inclusion of multilingual education, which, however, continued to provoke controversy and complaint. Classes were taught in the dominant language of the republic; but where a minority formed a large percentage of the population, teaching was conducted in the minority's language, and courses were offered on its history and cultural heritage. Vojvodina, with its five languages, was the best example of this principle in operation. However, a mastery of Serbo-Croatian was necessary for advancement to high-level positions in the state, party, and economic enterprises.



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The palace of the Roman emperor Diocletian made Split a major cultural center of Yugoslavia.

#### 4. Culture

Just as there has been no historic Yugoslav nationality, so there has been no single cultural tradition. The land thus reflects, on the one hand, the influence of the differing religions and cultures introduced through foreign occupation, and, on the other, the unique folk traditions of the individual regions. The heritage of Islam and Ottoman occupation is apparent in cities such as Bosnia's Sarajevo and Hercegovina's Mostar and in buildings such as the fortress of Kalemegdan, now a park in Belgrade. The Catholic-Habsburg past is mirrored in the baroque architecture in Slovenia's Ljubljana and Croatia's Zagreb. The spirit of Serbian Orthodoxy is seen in the monasteries and churches of Serbia and in sections of the older part of its cities. Along the Adriatic, Roman and Venetian rule are repeatedly recalled by the architecture of the port cities and of ruins such as that of Diocletian's palace in Split.

Although the peasant culture is fast disappearing, regional differences can still be seen in domestic architecture (particularly in the countryside), in the food, and sometimes in the dress. Attempts have been made to preserve some of the handicrafts. Ethnographic museums collect and display examples of this work, especially embroidery and wood carving, and folk music has been recorded to assure its preservation as part of the heritage of each national group. Buildings of historical significance, such as churches, mosques, and monasteries, have likewise been restored.

Literature has a particular significance for the Yugoslav national groups because of its role in shaping the individual cultures and in promoting the national revivals of the 18th and 19th centuries. Of major importance for each movement was the development of a standard literary language. Previously, Church Slavonic was the standard language for the Orthodox, and Latin for the Catholics. Since many of the clergy were trained in Russia, a Serbian literary language

emerged, known as Serbian-Slavic, which had a large percentage of Russian words. Writing in the early 19th century, two scholars, Dositej Obradović and Vuk Karadžić, challenged the use of this artificial form and proposed that the spoken language should be the basis of the literary language. Selecting as a standard a Hercegovinian dialect, Karadžić wrote a grammar and a dictionary.

Croatian writers were faced with a similar decision, though their difficulties were greater because their spoken language had three dialects. In the 1830s and 1840s the Illyrian movement in Croatia stressed the cultural and linguistic unity of the South Slavs. The movement's chief spokesperson, Ljudevit Gaj, proposed the adoption of the Hercegovinian dialect spoken by the majority of Croats. Hercegovinian was also the dialect chosen by Karadžić for the Serbs. The groundwork was thus laid for a standard Serbo-Croatian literary language, which would be used by Croats and Serbs in the Habsburg empire and by Serbs in Serbia and Montenegro. The language was, of course, written in the Cyrillic alphabet by Serbs and in the Latin alphabet by Croats.

In this same period the greatest Slovene poet, France Prešeren, and the prose writer Fran Levstik were influential in establishing standard Slovenian. This language is distinct from Serbo-Croatian but close to a dialect spoken in northern Croatia.

These authors were part of the Romantic school that dominated writing throughout Europe in this period. The Romantic movement fitted in well with rising Balkan nationalism. Among the Serbs the greatest writer was the poet prince-bishop of Montenegro, Petar Petrović Njegoš (Peter II), whose major work *Gorski vijenac* (*The Mountain Wreath*) is a masterpiece of Serbian poetry. In Croatia the major writer was August Senoa, whose best-known work is *Seljačka buna* (*The Peasant Uprising*). Another author, Ivan Mažuranić, wrote the epic poem



*Smrt Smail-age Čengića (The Death of Smail Aga Čengić).*

Realism in European literature was also reflected in the South Slav lands. Svetozar Marković, a major realist, was in addition the founder of Serbian Socialism. Historical writing, too, was important in this period. The Serbian Slobodan Jovanović and the Croatian Ferdo Šišić composed major works on the history of their people.

Painters and sculptors, like the writers, followed European trends closely. Many studied in Paris, Munich, or Vienna. Among the artists, special mention should be made of Ivan Meštrović, a sculptor trained in Vienna, who worked in Yugoslavia in the interwar period but emigrated to the United States after World War II.

Among post-World War II writers, three in particular attracted international attention. Milovan Djilas, repeatedly imprisoned because of his bitter criticisms of the Communist regime (as in *Nova Klasa*, translated into English as *The New Class*), also wrote about his homeland, Montenegro, in such books as *Besudna Zemlja (Without Justice)* and *Njegoš (Njegoš: Poet, Prince, Bishop)*. In 1961 the Bosnian writer Ivo Andrić won the Nobel Prize for literature. He is best known for his descriptions of life in Bosnia, in such works as *Na Drini Čuprija (Bridge on the Drina)* and *Travnička Kronika (The Chronicles of Travnik)*. The major figure in Croatia was Miroslav Krleža, a prolific writer of plays, essays, novels, and short stories. Of his works that have been translated into English, the best known is *Povratak Filipa Latinovicza (The Return of Philip Latinovicz)*.

Yugoslavia's Communist government supported the expansion and development of the theater, opera, and ballet. The republics devoted much attention to the production of radio and television programs and to the making of movies. Documentary and feature films were produced, and animated films made in Zagreb achieved a worldwide reputation.

### 5. The Economy

Since the founding of the Yugoslav state, all parties and leaders have sought to resolve the economic problems of the country through industrialization and modernization. But they have differed radically on the best means to achieve these goals.

The first task after 1918 was to rebuild the part of the country that had been devastated by World War I. Immediate attention also had to be given to the peasants' demand for land reform. Thus the large estates were divided, particularly in the former Habsburg lands, where they were often in the possession of enemy nationals.

In the interwar years Yugoslavia was a land of small peasant farmers, with about 75% of the population directly dependent on agriculture. Most of the farms provided only a bare subsistence for their owners, and the countryside was impoverished and backward.

The royalist government used subsidies and tariffs to advance the country's industrialization. It also owned certain enterprises; ran the telephone, telegraph, and radio networks; and held monopolies on salt and tobacco. The major industries in the interwar period were those closely related to agriculture, such as milling, sugar refining, alcohol distilling, and food processing. The textile, timber, woodworking, metallurgy,

and chemical industries were also important. The Bor copper mine and the Trepča lead and zinc mines were exploited. In foreign trade the chief exports were wheat, maize, hogs, lead, zinc, copper, timber, and hemp. After 1936, Germany was Yugoslavia's major trading partner.

World War II and Yugoslavia's civil war once again caused tremendous devastation. Not only did extensive areas need rebuilding, but with the victory of the Communist Party, plans were made to reorganize the economy along radically different lines. Following the precepts of Marxism-Leninism and, at first, adhering to the Soviet model, the new Communist government gave top priority to rapid industrialization. The factory workers in the highly industrialized state that was envisaged were to supply the basic support for the new regime.

From 1946 to 1948 a Stalinist pattern of economic organization and development was followed, with the chief emphasis on heavy industry and centralized planning. But after breaking with the Soviet Union in 1948, Yugoslavia's leaders adopted policies that were unique in the Communist world. Contending that there were different roads to socialism, they attempted to introduce patterns of organization that better fitted the character of their state and that allowed a greater degree of decentralization in the national economy.

In June 1950 the National Assembly passed a law that was to have the greatest significance for the future. Entitled "Management of State Economic Enterprises and Higher Economic Associations by Workers' Collectives," this measure introduced the idea of workers' self-management, an original contribution by Yugoslavia to socialism. In theory the state did not control the factories and other means of production. These were considered "social property." Each firm was to be run by workers' councils, elected by the employees of that firm. The director or manager of the firm, with whom the management board of the workers' council was supposed to work closely, was chosen by a commission with state and party representation.

A federal planning bureau continued to draw up a national economic plan, as did the individual republics and the lesser administrative units. These plans, however, were intended to be only advisory in nature.

Beginning in the mid-1960s, the government embarked on a policy of economic decentralization, with due attention given to market forces. Basic decisions were meant to be made by the individual enterprises, which were supposed to make a profit. Wages were to a degree dependent on profits. However, a struggle continued between those who favored a return to a more centralized economy and those who preferred the situation as it was or who called for even further decentralization.

**Agriculture.** Despite the postwar government's increasing emphasis on industrialization, agriculture continued to play a major role in the economy. Much of the country had a daunting terrain, and yet 58% of the land was used either for crops or for pasturage.

The Communist regime modified the Soviet model of agricultural organization and differed with the Soviet Union on the basic issue of land ownership. However, immediately after World War II, the government attempted to force the peasants into collectives and state farms. Peas-

ant resistance then led to the abandonment of forced collectivization and the breakup of most of the collectives. After 1953 the small, independently owned farm was reinstated, with a limit of 24.7 acres (10 hectares) placed on individual holdings except in mountainous or hilly country.

A serious effort was made to modernize agricultural techniques, increase mechanization and the use of fertilizers, and introduce improved seeds and livestock feed. The establishment of cooperatives gave individual farmers the advantages that were usually associated with large agricultural enterprises. Also, the cooperation between the state and private agriculture was considerable.

The one sixth of the farmland that was not in private hands was organized into *kombinats*, which functioned under the same principles of self-management as those adopted by industry. The large size of the *kombinats* (60% of the socialized land was organized into units of more than 12,350 acres, or 5,000 hectares) made possible the efficient use of machinery and technological advances.

Agricultural production expanded, but farming suffered from the emphasis placed on industrial development. One result was a lack of investment in the private farms that was needed to increase their efficiency. Moreover, many young men moved to the cities, leaving behind an aging and diminishing peasant population. Bad organization of the agricultural sector also resulted in unbalanced pricing and uneven distribution.

The major crops were maize (corn), wheat, sugar beets, sunflower seeds, fruit, rice, potatoes, tobacco, cotton, and soybeans. But the wheat grown was insufficient to satisfy domestic needs and had to be supplemented by imports. Of the fruit crop, apples and plums were particularly significant in both the domestic and foreign markets.

Meat figured even more prominently than crops in the country's agricultural exports. More often than not, livestock were fed on fodder rather than pastured on grazing lands, which were freed for conversion to other, more profitable agricultural uses.

**Lumbering.** With more than 30% of its area in forest, Yugoslavia ranked just after the Scandinavian lands and Austria as the most heavily forested country in Europe. Almost three quarters of the standing timber was hardwood, primarily oak and beech. Because the hardwoods were less suited to industrial processing than the softwoods, the state increased softwood plantings. It also aimed at reducing felling to a point below annual increments in the tree stands. In addition, it opened remote areas for logging in order to spare the more accessible forests that had been severely overlogged. The fact remained, however, that many forests were inaccessible, making it impossible to get the lumber out.

**Mining.** Yugoslavia's mountainous terrain has endowed it with a variety of mineral resources, and at least in nonferrous metals the country has been one of Europe's leading producers. In percentage of world production, the most important minerals after World War II were magnesite, lead, bauxite, antimony, copper, and zinc. The extraction of nickel, chromium, and mercury was also significant. Industrialization, however, was hampered by inadequate supplies of iron ore and by the low iron content of the ore that existed.

Consequently, Yugoslavia had to continue to import iron ore.

The primary fuel produced was coal, chiefly in the form of lignite, although brown coal also was mined. The production of crude oil and natural gas became significant after World War II, and exploration for new reserves was carried out in the Pannonian Basin and on and off the Adriatic coast.

**Energy.** Because Yugoslavia was intent on industrialization, shortages in energy resources presented a fundamental problem for its postwar economic planners. The country did not have a sufficient supply of high-grade coal suitable for steel production. Furthermore, Yugoslavia produced only a small percentage of the petroleum and natural gas it needed. Therefore, it had to import both bituminous coal and crude oil, which combined made up a large percentage of its mineral imports. Natural gas was brought in by pipeline from the USSR.

With domestic energy resources insufficient, hydroelectric power was developed. One project was a hydroelectric station at the Iron Gate gorge on the Danube. The major hydroelectric plants were, however, situated in the mountainous regions of Serbia and Bosnia-Herzegovina, relatively far from industrial centers. Moreover, an energy system based on water could be no more dependable than the source of the water, namely rainfall, which in Yugoslavia varies greatly from year to year. Droughts have led to a loss of electric power that has affected industrial production and living standards.

**Manufacturing.** Yugoslavia's primary economic goal after World War II was more rapid and extensive industrialization, with the introduction of modern technology throughout the industrial sector. The manufacture of metal products—particularly motor vehicles and various types of engines—came to be one of the country's chief industries. Shipbuilding also formed an important element in this sector. The textile industry, though dependent on imported raw materials and operating with outdated machinery, contributed significantly to Yugoslavia's exports. The chemical industry grew at a faster rate than any of the other industrial sectors; and as domestic crude oil was extracted, the development of petrochemicals was given a high priority. Food processing profited from the gradual modernization of facilities and equipment. Electrical industries grew rapidly as the needs of both industry and consumers for electricity and electrical equipment increased. The expansion of the wood industry fluctuated with changes in consumer buying power, particularly in such branches as furniture veneer, joinery, and lumber. Nevertheless, its long-term growth was fairly steady.

Both ferrous and nonferrous metallurgy made impressive gains because of the attention given to capital-goods industries. Yet domestic steel and copper production fell short of demand, with the result that these metals had to be imported. The output of most nonmetallic mineral products, such as tiles, bricks, asbestos goods, and rock salt, was sufficient to meet the country's needs, but cement production frequently did not keep up with demand.

In advancing the industrialization of the country, the state was under pressure from the poorer republics, such as Macedonia, Montenegro, and Bosnia, to introduce more heavy indus-

try in their areas. In trying to satisfy these demands, the Communist government built "political factories" in the backward regions—factories that made little economic sense because they did not improve either a particular industry or the overall economy.

**Labor.** As a heritage from its impoverished past, post-World War II Yugoslavia suffered from an oversupply of unskilled labor with no tradition of disciplined factory work. Skilled workers were in short supply; yet it was precisely this group that tended to emigrate, in particular to West Germany, where wages were higher and working conditions were better. At one time, close to 20 out of every 100 workers held jobs outside the country.

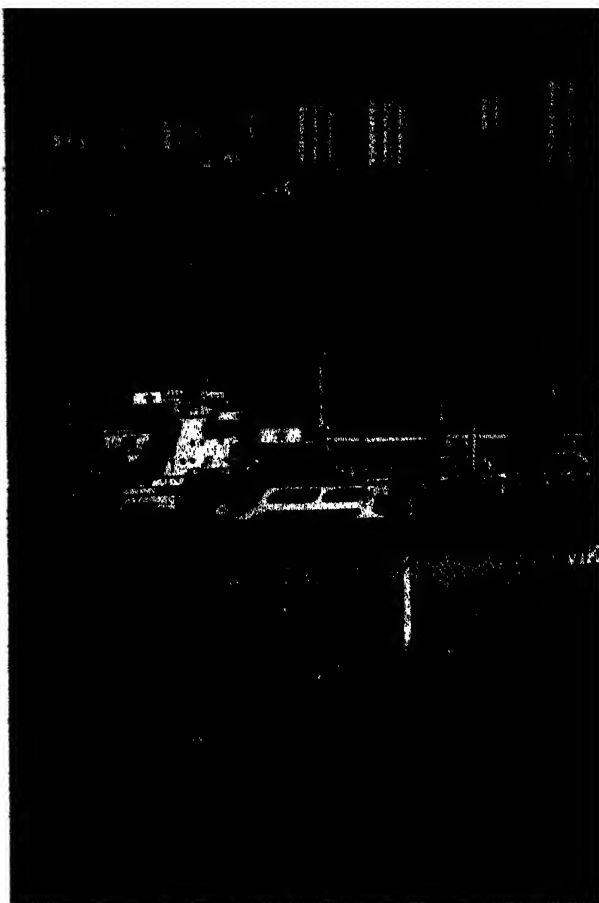
Because of the importance of workers to the economy and the political system, both the Communist Party and the government were concerned with the workers' well-being. Although the single labor organization, the Confederation of Trade Unions of Yugoslavia, was dominated by the party, Yugoslav workers did strike; and, in contrast to other Communist countries, the government tolerated these actions.

Despite the attention to their needs, Yugoslav workers suffered along with the rest of the nation whenever there was a general decline in the economy. In periods of inflation, wages did not keep pace with rising prices.

A significant number of Yugoslavs worked outside the state-controlled section of the economy, contributing to a "second economy." It was not uncommon for an individual to hold two jobs, one in a state enterprise and another in the private sector. The Communist government allowed small private enterprises employing up to five persons or staffed by family members. Thus many restaurants, bars, and barber shops were privately owned. Artisans, such as makers of shoes or handbags, often owned their shops. Plumbers, electricians, and mechanics also found private employment; in addition, professionals, such as lawyers, doctors, and dentists, could have private practices.

**Transportation.** Yugoslavia's railroad network was rebuilt and expanded after World War II. However, development of the system was hampered by the great cost of building new track through the difficult terrain. The major line runs southeast from the Austrian border near Jesenice to Belgrade, via Ljubljana and Zagreb. From Belgrade it continues south to Skopje and Greece, with a branch from near Niš traveling southeast to Bulgaria and Turkey. Belgrade and Zagreb are also connected by rail to Hungary, and Belgrade to Romania. Other lines serve the Adriatic coast. A railroad with feeders from Ljubljana and Zagreb connects Italy with the ports of Rijeka and Split. Another line runs from the Zagreb-Belgrade trunk route to Sarajevo, then through the Neretva Valley to the port of Ploče. A railroad also links Belgrade with the Adriatic seaport of Bar.

In general, the major highways parallel the railroad lines. The vast increase in the use of trucks for shipping goods and in the quantity of automobile traffic confronted the government with the need to improve the road network. Priority was given to industrial and tourist areas. Even though an ambitious nationwide program was adopted and foreign loans were obtained for some of the construction, Yugoslav highways remained inadequate to handle the heavy interna-



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Rijeka became Yugoslavia's leading port partly because of its superior land connections with the interior.

tional traffic that passed through the country—particularly from central Europe through Belgrade to Istanbul, in Turkey.

Yugoslav Air Transport (JAT) was developed as the principal Yugoslav airline, with both domestic and foreign service.

The Danube is navigable for its entire length within Yugoslavia, and its major tributaries—the Sava, Drava, and Tisa—are navigable for at least part of their lengths. Therefore, they have played a major role in internal transportation. With the exception of the Neretva, which is navigable for a short distance from Metkovic to the sea, the Dalmatian and Macedonian rivers cannot be used for transport.

**Foreign Trade.** In attempting to industrialize and modernize the economy rapidly, Yugoslavia had to import technology and capital goods, as well as basic raw materials and energy resources that it lacked. As a poor country, it needed outside assistance, particularly loans. After its break with the Soviet Union in 1948, Yugoslavia turned to the Western powers. The United States and the European Communities (EC) gave the needed aid, at least in part, in order to ensure that Yugoslavia maintained its independence of the USSR. After 1955, relations with the Soviet bloc improved. In 1964, Yugoslavia began to participate in the activities of the bloc's economic association, the Council for Mutual Economic Assistance (Comecon), but it did not become a full member. Credits were also obtained from this source. Despite efforts to improve trade, Yugoslavia ran up a large debt and suffered a chronically unfavorable balance of payments. In



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A child admires her new sandals from a small family-owned business allowed under Yugoslav socialism.

the 1980s, service on its foreign debt absorbed 25% of the country's foreign exchange.

In the early 1980s, Yugoslavia's trade was primarily with the EC, particularly with West Germany and Italy. Slightly over a third was with Comecon countries, and somewhat under a fifth was with Third World countries.

**Tourism.** Beginning in the 1960s the Yugoslav government made a determined effort to promote tourism. This sector of the economy not only earned foreign exchange that the country needed but also provided work for the unskilled unemployed. The relative openness of Yugoslavia's society allowed foreign visitors to travel freely.

The Adriatic coast, with its mild climate and long series of beaches, was the main area developed for tourism. The Adriatic highway permitted cars to travel on a modern road from Italy almost to the Albanian border. Modern hotel complexes were built, and rooms in private homes became available.

Slovenia's Alpine areas also attracted tourists. And in 1984, Yugoslavia held the Winter Olympic Games in Bosnia's capital, Sarajevo, in an attempt to develop this area for tourism.

## HISTORY AND GOVERNMENT

The Yugoslav state formed in December 1918 was composed of the territories of prewar Serbia and Montenegro, both of which had been independent states, and of Bosnia, Hercegovina, Dalmatia, Croatia, Slavonia (including Srem), Bačka, a small part of Baranja, and part of the Banat, all of which had belonged to Austria-Hungary. In addition, lands inhabited by Slovenes were annexed; Austria also claimed some of these lands, and in the final settlement that followed a plebiscite, Austria kept the Klagenfurt area. The bitterest conflict, however, came over Yugoslavia's border with Italy. That state was able to annex from Austria-Hungary the Küstenland (Görz-Gradisca, Trieste, and Istria), with a large South Slav population, in addition to some Dalmatian islands, the Dalmatian mainland city of Zara (Zadar), and later the major port of Fiume (Rijeka).

The joining of the South Slavs of the Habsburg monarchy with those of Serbia and Monte-

negro was made possible by the Allied victory in World War I. It was also the expression of the desires of those who supported the "Yugoslav Idea"—that the Serbs, Croats, and Slovenes were one people, who should form a single state. Although supported by only a minority, chiefly students and intellectuals, this concept became a reality largely because of the particular conditions prevailing at the end of the war. During the conflict a Yugoslav Committee, composed of émigré politicians from the Habsburg empire, had entered into negotiations with the Serbian government-in-exile on the Greek island of Corfu. In July 1917 a declaration was issued asserting the intention of creating a state composed of Serbs, Croats, and Slovenes, organized on a federal basis, with the Serbian Karadjordjević (Karageorgevich) dynasty at its head.

In the last months of the war, as the Habsburg empire collapsed into its national components, a National Council of Slovenes, Croats, and Serbs was formed in Zagreb. In November 1918 it declared its intention of uniting with Serbia. The Habsburg South Slavs feared that if they did not act, Italy would annex large sections of their territory. In the same month a Montenegrin national assembly also voted to join a union. On December 1, in Belgrade, representatives of the Habsburg South Slavs requested Serbian Prince Regent Alexander, acting for Serbia's King Peter, to proclaim the union. A new state, officially entitled the "Kingdom of the Serbs, Croats, and Slovenes," thus came into being.

### 6. Monarchical Yugoslavia

In order to administer the state until a constitutional assembly could be convened, a provisional government representing the various national groups and political parties was formed. In elections held in November 1920, two Serbian parties received the most votes: the Radical Party, which had been the prewar ruling party in Serbia, and the Democratic Party, which contained not only Serbs from Serbia but also former Habsburg Serbs and Croats who favored a centralized state. The Croatian Peasant Party, which was now the dominant Croatian party, and the new Communist Party both showed strength in the polls.

During the drafting of the constitution, considerable controversy was aroused by the government's insistence on a centralized administration. Before the final vote was taken, many delegates, including those of the Croatian Peasant and Communist parties, had withdrawn. Thus, in the final count only 258 out of 419 delegates voted, and of these only 223, representing a minority of the electorate, approved the final document. The constitution, adopted on June 28, 1921, established a constitutional monarchy. A unicameral legislature was to be elected by universal manhood suffrage. Under a highly centralized administration, the country was divided into 33 districts.

**Parliamentary Government: 1921-1929.** These troubled beginnings were to set the tone for the first years of the new state. Alexander, who became king in 1921, worked closely with Nikola Pašić, the major Serbian political figure from the prewar era, to maintain the centralized and Serbian-dominated regime. The task was not easy because the country was so divided: 43% Serbian, 23% Croatian, 8.5% Slovenian, 6% Bosnian Muslim, 5% Macedonian Slav, and 3.6%

Albanian, besides mixed minorities of other groups. Pašić attempted to solve his political problem by cooperating with the Radicals and Democrats and also by winning ministerial support of two other groups: the Bosnian Muslims, represented by the Yugoslav Muslim Organization, and the Slovenes, through their major political organization, the Slovenian People's Party, which reflected the interests of this strongly Catholic and peasant people.

The major opposition came from the Croatian Peasant Party. Under the erratic leadership of Stjepan Radić, it continued to win the strong endorsement of the Croatian electorate. The Serbo-Croatian antagonism dominated the political scene and made orderly government almost impossible. The government met the situation by outlawing the Croatian Peasant Party; Radić and other leaders were given prison terms. In March 1925, in a reversal of position, the party announced that it would cooperate with the government. The leaders were then let out of prison. Some received ministerial appointments, and their representatives took their seats in the assembly.

The death of Pašić in December 1926 removed the major Serbian political figure from the scene. The political situation broke down entirely in June 1928, when a Radical Party delegate from Montenegro shot five representatives of the Croatian Peasant Party. Among these was Radić, who subsequently died of his wounds. Facing a period of extreme internal crisis, Alexander on Jan. 6, 1929, abrogated the constitution, abolished the political parties, and dissolved the assembly. His personal dictatorship was to last until his death.

**The Royal Dictatorship: 1929-1934.** Alexander had taken full control of the country. He was in command of the army, he chose the highest officials, and he kept political life under tight police power. Radically revising the administration, he also changed the name of the state from the Kingdom of the Serbs, Croats, and Slovenes to Yugoslavia. In an attempt to weaken national loyalties, he reorganized the country into nine districts (*banovine*), whose boundaries did not conform to the historic regions. Although he justified his actions as an attempt to generate a Yugoslav national feeling, the government in fact continued to be controlled by Serbs from Serbia.

In September 1931 a new constitution was issued that provided a political framework for the dictatorship. A bicameral legislature was created, with half the members of the upper house appointed by the king. The lower house was to be elected by universal manhood suffrage and by open ballot. The party receiving a plurality was given more than two thirds of the seats. Since parties representing national groups and regions were forbidden, the government's Yugoslav National Party, with police assistance, won all the seats in the assembly in 1931.

The civil liberties of all the national groups, including the Serbs, were deeply infringed by these actions. Many party leaders were sent to jail, including Vladko Maček, the new head of the Croatian Peasant Party; others went into exile. Especially significant for the future was the activity of Ante Pavelić. In January 1929 this Croat went to Italy, where, with the support of the Italian Fascist leader Benito Mussolini, he founded the Ustaša (Insurgent) movement. It

advocated the achievement of Croatian independence—if necessary, by violent means. The organization cooperated with the Internal Macedonian Revolutionary Organization (IMRO), which aimed at ending Serbian domination in Macedonia. In October 1934 a Macedonian assassinated Alexander and the French foreign minister, Louis Barthou, in Marseille. This action had great consequences for Yugoslav foreign and domestic policies.

**The Regency: 1934-1941.** Because Alexander's son, Peter II, was only 11 years old, a three-man regency, headed by Prince Paul, was established. Paul not only faced continuing internal controversies but also a worsening general European situation and a weakening of Yugoslavia's system of alliances. In 1920 and 1921, defensive alliances had been concluded with Czechoslovakia and Romania. The three states together formed the Little Entente, which was aimed at those neighboring countries that had lost territory to them in the peace settlements after World War I. The Little Entente developed in close association with France, with which Yugoslavia signed a treaty of friendship in November 1927. But French diplomatic hegemony in eastern Europe was soon challenged by Italy's Mussolini. Dissatisfied with the Italian world position, Mussolini set in motion plans to organize the states injured in the peace settlements—namely, Austria, Hungary, Bulgaria, and Albania, all Yugoslavia's neighbors.

After June 1935, when Milan Stojadinović became premier, Yugoslav foreign policy began to shift. Although Prince Paul was personally inclined to the West, he recognized that, given his uneasy domestic situation, he would have to come to an agreement with his restless neighbors. In January 1937 a treaty of friendship was signed with Bulgaria, and in March a nonaggression and arbitration pact was concluded with Italy. These understandings broke the letter and the spirit of the agreements with France and the Little Entente states. Yugoslav foreign policy was also profoundly affected by the German absorption of Austria in March 1938, an action that gave Yugoslavia a militant new neighbor, and by the dissolution of Czechoslovakia in March 1939.

The Stojadinović government also tried a new direction in domestic policy. Some civil rights were restored, and many political prisoners were released. The premier based his government on a new official party, the Yugoslav Radical Union, which was composed of the Serbian Radical Party, the Bosnian Muslims, and the Slovene People's Party. Although attempts were made to conciliate the Croats, very little was done to modify the Serbian-dominated centralist nature of the regime.

In December 1938 elections were held that marked what was in fact a defeat for the government. Despite police interference the opposition parties, which included not only the Croatian Peasant Party but also others that wanted a better national representation or more political rights, gained 44.9% of the votes to the government's 54.1%. The increasing tensions in international affairs, combined with the internal situation, made a radical change necessary. In February 1939, Stojadinović was dismissed.

The new premier, Dragiša Cvetković, a member of the Serbian Radical Party, was expressly instructed to come to an understanding with the



Croatian Peasant Party. With Prince Paul closely involved, government representatives carried on negotiations with the Croatian party's leader, Vladko Maček. Shortly before the outbreak of World War II, the discussions came to a successful conclusion with the signing of the Sporazum Agreement of August 1939. In this document Croatia received the autonomous position that its leaders had consistently demanded. Included in the lands under Croatian control were Dalmatia, Croatia, Slavonia, and some Bosnian and Herzegovinian territory with a Croatian population. Of the 4.4 million inhabitants, however, 866,000 were Serbs.

Croatia was now to have its own assembly; the chief executive official, the *ban*, was to be appointed by the king. In such matters as defense, foreign affairs, and communications, Croatia continued to be associated with the rest of the country. Ivan Šubašić became the *ban*, Maček was appointed vice premier of Yugoslavia, and four members of his party received ministerial posts. This settlement, while meeting the major Croatian desires, caused resentment among the Serbs and demands from other national groups for similar concessions.

**The Axis Conquest.** Although an advance had been made toward easing domestic tensions, the international situation became increasingly dangerous. In April 1939, Italy occupied Albania. Germany's signing of a pact with the Soviet Union in August 1939, followed in September by the invasion of Poland and the declaration of war by France and Britain, inaugurated another long period of continental warfare. The defeat of France in June 1940, just after Italy entered the war, appeared to assure Axis domination of Europe. However, in October 1940, when Italy tried to invade Greece from Albania, the Italians were stopped by the Greek Army.

Although the German government had previously conceded to Italy the principal influence in Yugoslavia, a new situation developed that necessitated more direct German involvement. Since Germany was preparing to invade the Soviet Union and to assist Italy against Greece, the German leaders wished Yugoslavia to sign the Axis Tripartite Pact as an assurance of its benevolent attitude. On March 25, Cvetković and the foreign minister, Aleksandar Cincar-Marković, duly signed the document.

In protest, on the night of March 27, a group of officers carried out a successful coup. Gen. Dušan Simović became premier; Peter was declared of age, and Prince Paul resigned. Although the new regime did not denounce the Tripartite Pact, Hitler could take no chances in the Balkans. On April 6, Germany and Italy invaded Yugoslavia. They were aided by Hungarian troops, who entered Vojvodina; Bulgarian soldiers eventually occupied Macedonia. The war lasted only a short time, for an armistice was signed in Belgrade on April 17. The king and his ministers formed a government-in-exile in London. On June 22, Germany invaded the Soviet Union.

## 7. The Rise and Ascendancy of Tito

With German, Italian, Albanian, Bulgarian, and Hungarian troops in occupation and with puppet regimes in control in Belgrade, Zagreb, and Cetinje, resistance movements soon gained strength. The first to win attention was the "Croatian" detachment of the Yugoslav Army,

formed by Col. Draža Mihailović and a group of Serbian officers after the surrender. The Chetniks, closely associated with the government-in-exile and King Peter, supported an eventual return to the Serbian-dominated centralist regime and the prewar social and political structure. The second resistance force, the Partisans, was led by the Communist Party and its head, Tito (Josip Broz), although it attempted to attract to its ranks all the national groups and the parties that opposed the occupation. The Partisans were particularly successful in their operations in the remote mountain areas, where tactics of guerrilla warfare could be successfully employed. The two resistance armies, representing opposite political orientations, soon came into open conflict. By the end of 1943 the Allies, judging that Tito was fighting more effectively against the enemy, decided to provide the major aid to the Partisans.

Whenever the Partisans gained control of a region, they also set up an administration. In November 1942, at a conference held in Bihać, the leadership established a central body called the Anti-Fascist Council for the National Liberation of Yugoslavia (AVNOJ). In November 1943 at Jajce, AVNOJ was declared to be the government of Yugoslavia, in effect repudiating the government-in-exile. Britain, desiring to bring the two together, arranged for a meeting on the island of Vis in June 1944 between Ivan Šubašić, the premier of the London regime, and Tito. Here it was agreed that AVNOJ would be the recognized political authority, but that members of the London government should join it. Šubašić was to be postwar foreign minister.

Once the fighting had ceased, the victors proceeded with the partition of Yugoslavia. Germany annexed part of Slovenia and took control of the Banat, which had a large German population. Italy gained the rest of Slovenia and most of Dalmatia. Albania, now an Italian puppet state, was given the Kosovo area and some Montenegrin and Macedonian land. Hungary received Bačka and Baranja. Bulgaria, having occupied Macedonia, hoped that it would keep that area. The rest of the country was returned to its historic divisions. Serbia, assigned the boundaries it had had before the Balkan Wars of 1912-1913, was controlled by Germany with a government under Gen. Milan Nedić. Italy established a puppet government in Montenegro.

The most controversial political events, however, occurred in Croatia, which was placed under the control of Ante Pavelić and his Ustaša forces. In theory an independent state, Croatia was assigned Bosnia-Herzegovina as well as the historic lands of Croatia and Slavonia, and, after the surrender of Italy in 1943, Dalmatia. These territories contained a population of 6.5 million, of which only 3.4 million were Croats. The Ustaša regime organized a campaign of forced conversion or annihilation of the Serbian Orthodox. A condition of chaos and internal civil war soon developed, with open conflict between the Serbs and Croats resulting in high casualties.

On Oct. 20, 1944, Partisan and Soviet forces took Belgrade. As the fighting came to an end, the Partisans were in military control of the country. Tito then moved to crush any remaining resistance. When the representatives of the London government attempted to assume office they found their position untenable. The prewar Yugoslav parties were prevented from carryin'

on political activities. Major parties therefore refused to participate in the elections held in November 1945 for a constitutional assembly, and the voters had only the official Popular Front list before them. In a highly controlled election, 90% of the voters endorsed the government candidates. In 1946, Mihailović was captured and executed.

**Tito in Power.** In November 1945 the constitutional assembly abolished the monarchy and proclaimed the Federal People's Republic of Yugoslavia. Once firmly established, the government introduced Communist political and economic institutions. In 1963 the official name of the country was changed to the Socialist Federal Republic of Yugoslavia.

In the immediate postwar years, relations with the Soviet Union were good. A treaty of friendship and cooperation had been signed in April 1945. In contrast, conflict with the Western powers, particularly the United States, arose over ideological issues, the downing of two American aircraft in Yugoslavia, and Tito's dissatisfaction with the boundary settlement with Italy, in particular the failure to gain Trieste, which became a free territory. Yugoslavia did, however, win from Italy most of the rest of Istria, the city of Zadar (Zara), and Dalmatian islands.

By 1948, Tito's attempt to follow an independent foreign policy brought him into conflict with Stalin. In March 1948, Soviet military and civilian advisers were recalled. On June 28 the Cominform, the Soviet-dominated organization of Eastern European states, expelled Yugoslavia.

Finding itself isolated and in need of economic assistance, Yugoslavia then turned toward the Western powers. Despite their anti-Communist stance, the United States and other Western governments gave Tito both economic and military assistance. Relations were improved with neighboring non-Communist Greece, Italy, and Turkey. In 1954, Yugoslavia and Italy signed an agreement finally settling their boundaries. By its terms the Free Territory of Trieste was divided, with Italy receiving the city and a seacoast connection to it but with Yugoslavia taking the major portion of the territory.

After the death of Stalin in March 1953, diplomatic relations with the Soviet Union and the Communist bloc gradually improved. In May 1955, Nikita Khrushchev and other Soviet leaders came to Yugoslavia; in June 1956, Tito returned the visit. Yugoslavia did not, however, rejoin the Communist alignment. Instead Tito attempted to establish a third camp of neutral, or nonaligned, nations. In this endeavor he cooperated with other leaders of newly independent states or of those states that had refused to join either of the Great Power blocs. Relations with the Soviet Union cooled after the Soviet invasion of Hungary in 1956 and especially after the occupation of Czechoslovakia in 1968. Although a visit by Soviet leader Leonid Brezhnev in 1971 marked an improvement in the atmosphere, Tito maintained his independent attitude until his death.

**The Collective Presidency.** The constitution of 1974 called for a collective presidency consisting of a president and one representative from each of the six republics and the two autonomous provinces. The members of the presidency were elected for a period of five years by the Assembly



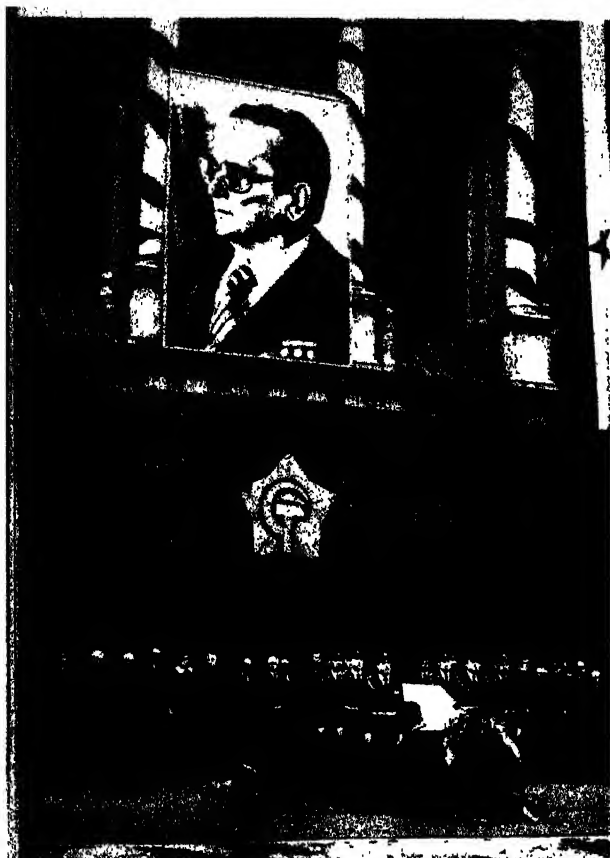
Tito (Josip Broz; at right) with members of his staff at Partisan headquarters during World War II.

of the Socialist Federal Republic of Yugoslavia (SFRY), the highest body of the government. In 1974, Tito was made president of the country for life, and by virtue of this position, he became president of the collective presidency. The office of vice president rotated on an annual basis among members of the collective presidency.

When Tito died in May 1980, the vice president for that year succeeded him as president of the collective presidency. When the new president's annual term ended, the next in line under the system of rotation replaced him as the president for the succeeding year. Afterward the system of rotation continued to function as intended.

## 8. Yugoslavia After Tito

Marshal Tito had stage-managed his succession in the form of an elaborate power-sharing arrangement that replaced his own charismatic authority. Post-Tito politicians rotated rapidly in the collective leaderships of the Communist party and the state. Within the party—officially the League of Communists of Yugoslavia (LCY)—were ten key political organizations: the federal party, the eight regional parties, and the party organization of the Yugoslav armed forces. Most federal political jobs, including those in the foreign ministry and the diplomatic corps, were apportioned on the bases of regional identity (the home republic or autonomous province) and ethnic identity within the region (reflecting the Muslim, Serb, and Croat composition of Bosnia-Herzegovina). A consensus of the six republics and two provinces served as the standard basis of decision making. This complex quota system had a logical continuity with the fundamentals of Yugoslav self-management: democratization, decentralization, debureaucratization (less bureaucracy), and deprofessionalism (bringing citizens into the political process through self-managing institutions in local government, such as "people's councils" and numerous commissions).



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Marshall Tito, who became president of Yugoslavia for life in 1974, lies in state after his death in 1980.

In view of the affection for Tito and insecurity over his passing, power sharing was legitimized by its being Tito's own political legacy. Yet in the context of an already highly decentralized federalism, in which the federal government retained control over only foreign policy, national defense, and an ambiguously defined "united market," the linking of political position to regional and ethnic identity undermined national integration and therefore national unity. The dizzying speed of political rotation limited opportunities to build a name with public recognition. And decision making by consensus gave the leaders of the republics and autonomous provinces what amounted to veto power.

The difficulties of Tito's successors were exacerbated by the country's Western debt, which was estimated at \$20 billion in 1980. Politically the new leaders needed the afterglow of the Tito personality cult. Their legitimacy was a corollary of their commitment to "guarding Tito's way." At the same time, they were uncomfortably saddled with blame for his economic mismanagement. By 1983 the Krajer Commission on Economic Stabilization had recommended a long-range program to repair the economy under the supervision of the International Monetary Fund (IMF).

It soon became apparent, however, that the government did not have the power to push these measures through without the cooperation

of the regional politicians. But, as with the campaign for market socialism in the 1960s, the political leaders of the republics and provinces could not agree on the distribution of the benefits and burdens of reform.

Throughout the 1980s the Yugoslav economy reeled under the burden of debt servicing. The IMF and Western financial circles would reschedule debts only at the price of imposing another painful austerity program. Unemployment rose. Inflation galloped forward, topping 2,000% in 1989, while the standard of living for ordinary Yugoslavs declined. Notwithstanding the commitment to the nonaligned movement, symbolized by hosting the movement's 1989 summit in Belgrade, the imperatives of debt servicing and of relating to the 1992 economic integration of the European Community (EC) dominated post-Tito foreign policy.

While Tito's memory dwarfed his successors, the economic crisis that he left them ruled out economic performance as a source of their legitimacy. Yet their perceived right to govern depended on their delivering on the promises of a smoothly functioning welfare state in which the standard of living improved steadily. The post-Tito "parcelization" of power slowed the ability of the government to act. When Premier Branko Mikulić resigned in December 1988, he insisted that blame for the economic crisis went far beyond the federal center, for regional Communist politicians were infected with economic as well as political nationalism.

The populist tactics of Serbian strongman Slobadan Milošević succeeded in partially reintegrating the autonomous provinces of Kosovo and Vojvodina into Serbia, at the cost of strikes, riots, and deepening distrust among Kosovar Albanians. Criticism by Slovenes of what they saw as Serbian ambitions to gain hegemony in Yugoslavia widened the circle of conflict. Slovenes rewrote their constitution to claim sovereignty explicitly and reiterated their federal right of secession. The escalating polemics, which soon expanded to Croatia, contributed to 1990 election victories of the united Slovene opposition (DEMOS) and the Croatian Democratic Union (CDU). Political parties proliferated in Serbia as well.

The LCY, which had given up its monopoly of power in January 1990, withered away. Asserting that Yugoslavia would function with or without the LCY, Premier Ante Marković set up his own Alliance of Reform Forces in support of the government's agenda. His anti-inflation program had slowed price increases to a crawl; and he had already reduced the Western debt to roughly \$16 billion, while cutting back the ratio of foreign currency tied up in debt servicing from 45% to 16%. More important, Marković had created the legal infrastructure needed to move forward on economic reform.

By midsummer, Yugoslav economic reforms had far outstripped the Polish road to capitalism. Politically, however, Marković's reform party was no match for Serbian president Milošević's Socialist Party of Serbia (former Communists) or nationalist parties in Bosnia-Herzegovina and Macedonia. As 1990 ended, multiparty elections in the six republics had brought to power center-right coalition governments in Slovenia and Croatia, nationalist-dominated coalitions in Bosnia-Herzegovina and Macedonia, Milošević's renamed Communists in Serbia, and the Con

munist Party of Montenegro. Divided over the federal or confederative nature of the country's future political system, these republic politicians could not agree on procedures for conducting the promised federal elections.

In the meantime, new players joined in the struggle between the imperatives of economic reform and national self-determination. By changing the Croatian constitution, Franjo Tudjman's CDU responded to pressure by Croatian voters to deal with what many Croats had come to feel was second-class citizenship in their own republic. Memories of World War II atrocities intensified fears of the roughly 600,000 Serbs in Croatia (about 12% of the republic population). There were violent incidents, a referendum demanding Serbian autonomy in Croatia, and appeals to Serbia and the Yugoslav army for protection. The Croatian government refused to recognize the self-proclaimed Serbian autonomous region of Krajina, established a republic militia to deal with "criminals" barricading the main road to the Dalmatian coast, and blamed Serbian President Milošević for manipulating the fears of the Serbian minority. Serbs, in turn, were more and more convinced that Tudjman's government was intent on subjugating Croatia's Serbian minority.

Ethnic tensions escalated following a financial scandal brought about by the Serbian parliament's decision to issue \$1.8 billion in new money without informing the federal govern-

ment. Faced with a World Bank warning that credit to Yugoslavia would be cut off if the premier's market-based reform program was abandoned, Serbia agreed to some restitution, but its economic credibility never recovered. Milošević's reputation suffered at home and abroad. By March 1991 massive demonstrations against the Serbian president's heavy-handed political tactics as well as his economic mismanagement appeared to have weakened his control within Serbia itself.

In an abrupt role reversal, Borisav Jović, the Serbian president of the state presidency, resigned. Milošević refused to recognize the authority of the federal presidency, while the "sovereign" republics of Slovenia and Croatia came to the defense of Yugoslav unity with calls for a meeting to preserve the federation. The European parliament reiterated its concern for Yugoslav integrity, pledging a \$1.1 billion loan and promising to open negotiations on associate membership for Yugoslavia to the European Community.

This window of opportunity slammed shut, though, with a subsequent Serbian-Montenegrin move to block Stipe Mesić, a Croatian, from rotating into the office of president of the presidency on schedule. Slovenia and Croatia declared "independence" at the end of June. Shooting began when the Yugoslav army tried to reestablish the federal customs presence on Slovenia's international borders. Although an EC-brokered cease-fire monitored by Community observers in Slovenia held, by August the violence rapidly escalated in the Krajina region of Croatia. Local Serbian authorities, who had served warning that they would not live in a Croatia outside of Yugoslavia, declared that they were uniting with Bosanka Krajina in Bosnia-Herzegovina to form a "greater Serbian community."

Political dialogue among republic leaders now collapsed into polarized confrontation. The Serbian agenda shifted to that of a rump Yugoslavia minus Slovenia and Croatia. Hardliners within the Yugoslav armed forces more and more openly supported Serbian irregulars battling Croatian militia in what appeared to be a Serbian land grab. Macedonia stated that it was unwilling to coexist in any such greater Serbia and declared its own "independence"; Bosnia-Herzegovina soon did so as well. The Croatian leadership desperately attempted to "provoke Germany into following through on its threat to recognize Croatia if Serbian insurgents and their supporters did not stop fighting. Slovenia struggled to consolidate the gains of early summer. As Germany, Italy, Austria, and Hungary recognized Croatian and Slovene passports, Yugoslavia ceased de facto to exist.

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Croatians hold a pre-election rally in 1990. The next year Croatia declared its independence from Yugoslavia.

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**YUKAWA HIDEKI**, yōō-kā-wā hē-de-kē (1907–1981), Japanese physicist, who won the 1949 Nobel Prize in physics for his work on mesons. He was born in Tokyo on Jan. 23, 1907, and graduated from the University of Kyoto in 1929. Attracted to theoretical atomic physics, he did intensive work from 1929 to 1935 on the theory of elementary particles. During those years the picture of the atom was undergoing radical and rapid change. In 1911, Ernest Rutherford had proposed a model of the atom which closely resembled the solar system, with electrons orbiting about a central, positively charged nucleus. The study of radioactive substances had shown that the nucleus itself was a highly structured body containing alpha and beta particles. The discovery of the neutron by James Chadwick in 1932 added another nucleon whose presence in the nucleus had to be accounted for by theory. It was becoming increasingly clear that the simple gravitational and electromagnetic forces of macrophysics were not sufficient to explain how nucleons were bound together into a stable body. Attempts were made to reduce nuclear forces to the forces associated with the known nuclear particles, but the calculated values were always much too small.

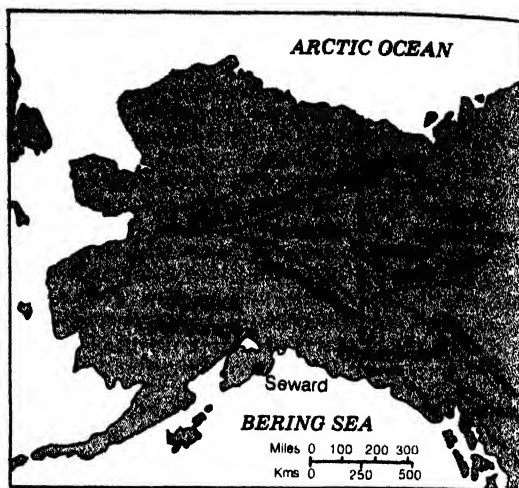
To fill this gap, Yukawa introduced the idea of the meson field and in 1935 predicted the existence of still another particle, the meson. In 1937 particles intermediate in mass between the electron and proton were discovered in cosmic rays. This discovery confirmed Yukawa's prediction and gave great impetus to the development of nuclear theory. Yukawa received the 1949 Nobel Prize in physics for this work.

In 1939, Yukawa became professor of theoretical physics at the University of Kyoto. He was visiting professor at Columbia University in 1949–1953 and then returned to Japan as director of the Research Institute for Fundamental Physics at Kyoto from 1953 to 1970. He died in Kyoto on Sept. 8, 1981.

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*Cornell University*

**YUKON RIVER**, yōō'kon, one of the longest rivers in North America. It is located mainly in Yukon Territory, Canada, and the U.S. state of Alaska. The river drains an area of about 360,000 square miles (930,000 sq km), of which some 127,000 square miles (330,000 sq km) are in Canada. The Yukon rises from one of its principal sources only 15 miles (24 km) from the Pacific Ocean in northern British Columbia. It pursues a tortuous route of over 1,900 miles (3,057 km), generally north and west, before terminating in Norton Sound, an arm of the Bering Sea, on the west coast of Alaska. Its course through Alaska extends 1,265 miles (2,035 km).

Small steamships formerly operated along the upper Yukon (then known in this sector as the Lewes River) for a distance of 100 miles (160 km) between Bennett Lake, on the British Columbia-Yukon Territory border, and the dangerous waters of Miles Canyon and Whitehorse Rapids in Yukon Territory. Below these impediments large sternwheeler steamships and tugboats once plied the river's waters during a five-month navigational season from the city of Whitehorse all the way to the sea, 1,777 miles (2,860 km) downstream. From Whitehorse the river continues northward in Yukon Territory through Lake Laberge to a junction with the Teslin River, then



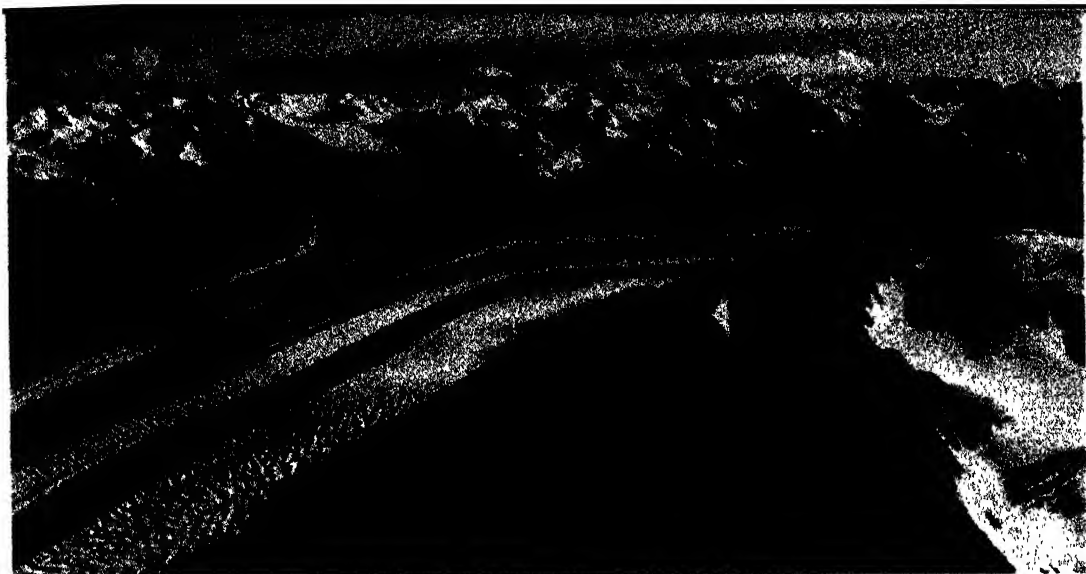
with the Big Salmon River and the Pelly River, its principal tributary in Canada. From there the Yukon flows northwest with many windings, being joined in succession by the White, Stewart, and Sixtymile rivers, and (at Dawson) by the Klondike, a river celebrated for the gold rush in the years after 1896 (see KLONDIKE). After receiving the Fortymile River, locale of another gold discovery, the Yukon enters Alaska, maintaining its northwesterly route as far as Fort Yukon on the Arctic Circle, where the river is joined by the Porcupine from the northeast. Thereafter the Yukon follows a southwesterly course across Alaska to its mouth, the chief tributaries being the Tanana and Koyukuk rivers.

In its lengthy course the Yukon passes through many sorts of terrain. Its headwaters in the Stikine, St. Elias, and Coast mountains are characterized by scenic valleys, rocky gorges, and long, finger-shaped lakes. Below Whitehorse the Yukon system has worn deeply terraced valleys as it flows through the elevated Yukon Plateau. After entering Alaska the river meanders in innumerable channels through the Yukon Flats, a region of shifting sandbars and low wooded islands. Below the mouth of the Tanana the Yukon becomes a huge, muddy stream flowing through a broad spruce-covered plain and finally terminates in a marshy delta.

From 1866, when the first small steamer ascended the Yukon, the river became the principal means of transportation and communication for interior Alaska and the Yukon Territory, and traffic attained considerable volume following the discovery of gold in the Klondike region. Railways, roads, and air services have displaced the river, and only private vessels and tour boats still use the mighty waterway. Proposals to develop the enormous hydroelectric potential of the Yukon system include reversing some of its headwaters to flow directly to the Pacific Ocean by way of the Taku River, or damming the main river at the Ramparts, 100 miles (160 km) northwest of Fairbanks, Alaska. But except for a small hydroelectric plant above Whitehorse, the Yukon remains unharnessed and little traveled, flowing in almost primitive solitude, alongside or through national wildlife ranges for most of its length in Alaska.

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Kaskaulsh Glacier in the Yukon's St. Elias Mountains, in which rise Canada's seven highest peaks.

**YUKON TERRITORY**, yōō'kon, a region of Canada, established as a separate territory in 1898. It was named for the Yukon River, called *Yu-kun-ah* ("great river") by the Indians. Comprising the wedge-shaped northwestern part of the Canadian mainland, the Yukon is bounded on the north by the Beaufort Sea, on the east by the Northwest Territories, on the south by British Columbia, and on the southwest and west by the state of Alaska. With an area of 186,300 square miles (482,515 sq km), equal to 4.9% of Canada's total, but with a population of only 23,153 (1981 census), the Yukon is one of the most sparsely settled regions of the world. Whitehorse is the capital and largest city (population, 14,814).

The Yukon probably still is best known for the Klondike gold rush in the late 19th century, an event whose drama and romance is celebrated in the short stories of Jack London and the poems of Robert Service. Nowadays, the gold rush is remembered by two major celebrations: Discovery Day, in Dawson on August 17, commemorating the great Klondike gold strike of 1896, and the Sourdough Rendezvous, in Whitehorse in February, honoring the prospectors, called "sourdoughs," who braved the wilderness in search of riches. See **KLONDIKE**.

**The Land.** Mountain chains stretch across the Yukon in a northwesterly direction. The lofty, scenic, icefield-encrusted St. Elias Mountains in the southwest include Canada's seven highest peaks, headed by Mt. Logan at 19,524 feet (5,951 meters). Northern extensions of the Rocky Mountain chain form part of the eastern border, then swing west across the Yukon in the Ogilvie Mountains.

Most of the territory is rugged, rolling, elevated plateau, intersected by precipitous rivers that have incised deep valleys. They include the headwaters of the eastward-flowing Liard River and the numerous tributaries of the mighty Yukon River, notably the Teslin, Pelly, Stewart, and White rivers. In the north are the basins of the Peel and Porcupine rivers and the Richardson and British mountains.

**Climate.** The Yukon's climate is extreme northern because of its Arctic-subarctic location and high elevation, and because the Coast Ranges bar mild Pacific winds from the territory. Winters are long and severe, with January tem-

peratures averaging  $-18^{\circ}\text{F}$  ( $-28^{\circ}\text{C}$ ), while summers are short, with about three months (June–August) between the last and first freezing temperatures. The lengthened summer days quickly bring forth a rich profusion of colorful wildflowers, including the fireweed (*Epilobium angustifolium*), the floral emblem of the Yukon. Annual precipitation is in the range of 9–13 inches (230–330 mm), comparable with the most arid parts of Canada's prairie provinces.

The climate and elevation slow the growth of the Yukon's forests. Also, these factors, as well as limited suitable soil areas, sharply reduce opportunities for successful farming.





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Dawson, the thriving center of the Klondike gold rush, is now a quiet village on the banks of the Yukon River.

**Resources and Economy.** Only two of the Yukon's natural resources—fur and minerals—have given rise to industries that direct their products to export markets. Timber finds local uses as fuel and building material but is not yet a commodity of external trade. Hydroelectric power, which has enormous potential in the Liard and Yukon river basins, has been developed only to meet local needs. Similarly, the produce of the territory's few small farms and ranches is consumed locally.

**Wildlife.** Fur-bearing animals, including muskrat, lynx, mink, marten, and beaver, provided the source of the Yukon's first and longest-lasting export industry—the fur trade. Game animals, such as mountain sheep and goats, caribou and moose, and grizzly and black bears, furnish food and skins for the population and attract visiting hunters. Among other edible wildlife are hares, ducks and geese, and salmon and other kinds of fish.

**Minerals.** Gold mining was the Yukon's leading industry until the 1950's. The large Klondike operation closed in 1966, but small operators, encouraged by the high price of gold since 1970, continue to mine with bulldozing equipment at many creeks. Between 1920 and the 1970's there was a major silver-lead operation in the Mayo district. Three new mining operations went into production in the mid-1960's—a large lead-zinc mine at Faro in the Ross River section, a copper mine near Whitehorse, and an asbestos mine at Clinton Creek near Dawson. Small tonages of low-quality coal also have been mined at Carmacks for local customers. Prospecting for gas and oil began in the 1950's, but there have been no major finds.

While mineral resources can provide relatively high-income employment, such employment is uncertain because of ore exhaustion or of closings resulting from unfavorable markets. "Boom and bust" characterizes the Yukon's mining-based economy, with growth in certain periods, as during the Klondike gold rush and the 1960's, and decline in others, such as 1982–1983, when the territory's metal mines were closed, with great damage to the economy.

**Tourism.** In the Yukon, tourism is a major source of revenue, with about 325,000 visitors each year. The territory's scenic beauty, dramatic history, and contiguity with Alaska have drawn tourists since the early 20th century. Early visitors traveled to Whitehorse from Skagway, Alaska, by train and on to Dawson and farther up the Yukon River by steamer. Today visitors arrive by air or by automobile and tour the Yukon and Alaska by road. Government aid to tourism includes advertising campaigns, incentives to improve facilities, and historical reconstructions, particularly at Dawson.

**Transportation and Communications.** The Yukon River and its major tributaries furnished the principal means of transportation until World War II. In response to the Klondike gold rush, the narrow-gauge, 110-mile (177 km) White Pass and Yukon Railway was built to connect Whitehorse with Skagway as an opening to the Pacific. Also in the wake of the gold rush, telegraphic communication was established between Dawson and Ashcroft, British Columbia. Wireless communication has replaced the largely unserviceable 1,200-mile (1,900-km) telegraph line, and the railway has faced hard times, especially since 1982.

During World War II the United States built the graveled Alaska Highway from Dawson Creek, British Columbia, to Fairbanks, Alaska, passing through the southern Yukon; a 160-mile (265-km) road from the highway in the Yukon to the seaport of Haines, Alaska; a Canol Road southwestward from the Northwest Territories to the Alaska Highway; and an oil refinery at Whitehorse and oil pipelines along most of the roads. Also, airfields at Watson Lake and Whitehorse were improved. After the war the refinery and most pipelines were removed, and the Canol Road was abandoned. However, the other facilities remained, and additional roads and airfields have been built.

The Yukon's roads total about 2,775 miles (4,465 km). Modern highways have been constructed from Whitehorse to Dawson; from the Alaska Highway to the mining centers of Faro in the Yukon and Tungsten in the Northwest Terri-

tories; and from Dawson to Fort McPherson and Inuvik in the Northwest Territories—the Dempster Highway, which nearly reaches to the Beaufort Sea.

Whitehorse is served by major air services and is the main center for regional air carriers engaged in such activities as local transportation, surveying, and prospecting.

Radio and television service are provided by the Canadian Broadcasting Corporation and private stations, and Canadian National Telecommunications link the Yukon by telephone to the outside world.

**Government.** The Yukon Act, which established the territory in 1898, provided for a federally appointed commissioner and a territorial council to enact local ordinances that the federal cabinet could disallow. At first the council was comprised of federal officials, but by 1909 it consisted of 10 elected members. A small territorial civil service was set up to handle such local concerns as schools, roads, and municipal affairs.

Council membership was reduced to three in 1919 because of a sharp decrease in population, but after activity quickened during World War II, membership was increased, reaching 16 in 1978. In 1961 the council received greater responsibility when three members began serving on a financial advisory committee. In 1970 two councillors (three, beginning in 1974) were appointed to an executive committee to participate with the commissioner and deputy commissioner in departmental administration. Since 1978 the council, renamed the legislative assembly in 1974, functions along party lines, under a government leader and a five-member cabinet drawn from the majority party. The commissioner approves all legislation and is responsible to the federal government.

The assembly has endeavored to gain control of certain fields under federal jurisdiction and aims toward eventual provincial status. The federal government has been unresponsive, contending that the territory's small population and reliance on federal financial aid argue against full self-government and provincial control of the region's natural wealth.

Since 1902 the Yukon has been represented in the House of Commons by one member. Fol-

lowing many years of direct management by the territorial government certain population centers now have elective municipal offices. A judge presides over the territorial supreme court, and 32 appointed justices of the peace handle local judicial matters. The Royal Canadian Mounted Police serve under contract as the police force.

**Social Services and Education.** Yukoners receive about the same aids and services as other Canadians. These include family allowances and pensions; free hospitalization and medical service under the national health program; facilities for senior citizens and other special groups; unemployment insurance and workmen's compensation; loans for public utilities and housing; and subsidized housing for low-income families.

Enrollment in the territory's some two dozen schools, including Roman Catholic schools in Whitehorse, is about 5,000. The system includes kindergartens and elementary and secondary schools, all of which follow the curriculum of British Columbia; a technical and vocational training institute; and adult-education programs. A Yukon college has been established to administer all postsecondary programs, but for a university education students still must travel outside the territory.

**History.** Since the Yukon Territory lies athwart the migration path from Asia to the Americas, human occupation of the area may have begun as early as 30,000 years ago. In historical time the Yukon was inhabited by nomadic hunting and fishing Athapaskan Indian peoples—in the north, in the Yukon River basin, and in the mountainous southeast. Tlingit Indians from the Pacific coast lived in the southwest. A small Inuit (Eskimo) population was found in the Arctic region.

Fur traders of the Hudson's Bay Company were the earliest white men to explore the present Yukon Territory. In 1840, Robert Campbell reached the Pelly River, which he descended in 1843 to its mouth in the Lewes River, as he called the upper Yukon. There he built Fort Selkirk in 1848. In 1851, Campbell followed the Lewes downstream, arriving at Fort Yukon in Alaska, thus discovering that the Lewes was the upriver extension of the Yukon. The entire river was named the Yukon in 1949.

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A Klondike merchant used a tent to serve his customers during the gold rush in the 1890's. Thousands of prospectors, called sourdoughs, braved the discomforts of the Yukon wilderness in search of riches.

The Hudson's Bay Company found the upper Yukon region too difficult to supply for extensive trade and soon abandoned the area. However, an increasing number of free traders and gold seekers moved in from Alaska via the Yukon River. Beginning in the early 1880's travelers also made their way to the Yukon from newly established ports on Lynn Canal in Alaska, climbing the steep passes of the coastal mountains to reach the navigable headwaters of the Yukon River. In 1894 changing conditions in the Yukon prompted the Canadian government to send a North-West Mounted Police officer to study the situation. The next year a detachment of police was moved there to keep order and to represent federal departments, and the Yukon became a district of the Northwest Territories.

In mid-August 1896, George W. Carmack and two Indian companions made a stunning gold strike on Bonanza Creek, a tributary of the Klondike River. The gold rush that followed brought world fame to the Yukon and was the highlight of its history.

Shortly after the find thousands of people headed for the goldfield. Steamboats plied the Yukon River, and the White Pass and Yukon Railway was completed in 1900. Near the confluence of the Yukon and Klondike rivers, the city of Dawson was built. It became a thriving frontier town, known as the Paris of the North, with a population that reached 25,000 in 1898. That year the Yukon was created a separate territory, with its capital at Dawson.

The Yukon appeared to be on the verge of a brilliant future, as the gold rush reached its peak in 1898-1899. But the richest placers were being worked out, few new discoveries were made, and other industries failed to develop. The gold operation was taken over by large companies able to work leaner gravels profitably by introducing cost-cutting methods, such as the use of hydroelectric power, high-pressure hoses, and huge dredges. Although gold production increased for a time, profits went to outside investors, rather than to developing the Yukon, and the territory slipped into a prolonged decline. In 1931 the census recorded 4,230 Yukoners, down from 27,219 in 1901. Once-booming Dawson, which lost its capital status to Whitehorse in 1953, had only 819 inhabitants.

During World War II, mainly as a result of construction of the Alaska Highway and oil pipelines, the Yukon saw another large influx of people, up to 35,000 military personnel and civilians in 1942-1943. Following the war, the population declined, to 9,096 in the 1951 census. Since then, however, with the expansion of economic activity and government employment, the population has increased fairly consistently among both whites and native inhabitants. Aided by such factors as improved health services and greater economic opportunities, the native residents number about 7,000, or nearly 30% of the Yukon's people.

MORRIS ZASLOW, *Author of*  
*"The Opening of the Canadian North"*

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**YUMA**, yōō'mā, a city in Arizona, the seat of Yuma county. Situated on the Colorado River, in the extreme southwest part of the state, Yuma is 166 miles (258 km) southwest of Phoenix. It derives its name from the Yuma Indians, whose reservation is nearby. Yuma is an important agricultural center in an area of irrigated farms producing lettuce, citrus fruits, dates, melons, and alfalfa. Also important to the economy are extensive livestock-feeding operations, tourism, and light manufacturing. The Yuma Test Station, a major hot-weather testing point for Army matériel, is 26 miles (47 km) north of the city, and a Marine Corps air station is on the outskirts.

Places of interest include the Yuma Territorial Prison State Park, a museum housing many relics of Yuma's lively history; the Century House Museum, with exhibits from Arizona's territorial period; the Custom House, a military supply center in the 1870's; and St. Thomas Mission, an adobe structure on the reservation Martinez Lake, on the Colorado River, 35 miles (56 km) north of Yuma, provides recreational facilities, and a rodeo is held each February.

Hernando de Alarcón, who sailed up the Colorado River in 1540, probably was the first white explorer of the region. Father Francisco Garcé established a mission in 1779, but it was abandoned in 1781 when he was killed by Indians. The town of Colorado City sprang up in 1854 at the ferry crossing of the Colorado River, after the discovery of gold in California. Its name was changed to Arizona City in 1858. In 1862 this settlement was destroyed by a flood, and a new community was formed on higher ground. It was renamed Yuma and incorporated in 1873. Yuma has a council-manager form of government. Population: 42,433.

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 Librarian, Yuma City County Library

**YUMA INDIANS**, yōō'mā, one of the major tribes of the Yuman branch of the Hokan linguistic stock. They originally lived on both sides of the lower Colorado River, around the site of the present city of Yuma, Ariz. Encountered by Hernando de Alarcón in 1540, they were first mentioned by name by Eusebio Francisco Kino in 1702 and were in frequent contact with subsequent explorers and travelers. The meaning of the name is unknown; it may be an error in understanding *yamayo*, "a chief's son." The people call themselves Kuchiana; current usage substitutes Quechan as the name for this tribe.

The traditional culture of the Yuma is similar to that of their congeners, the Mojave. They believed in a creator, Kwikumut, who made all things. Religious customs included a strong belief in dreams and great annual public mourning ceremonies. The tribe was divided into settlements of several hundred people each. Food was gathered and cultivated, and hunting was minimal. The Yuma were somewhat warlike and made effective use of a short "potato masher" club in hand-to-hand combat. The men often went naked, and the women wore short bark-cloth aprons, decorating their bodies with paint. Yuma art was not highly developed; functional pottery and, occasionally, simply modeled clay effigy figures were made. The tribe lives on Fort Yuma Reservation in California, across the Colorado River from the city of Yuma.

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**YUNG LO**, yōng'lū, the era name ("Perpetual Happiness") of the third emperor of the Ming dynasty in China. His personal name was Chu Ti; his dynastic name, Ch'eng Tsu.

Chu Ti was born in Nanking on May 2, 1360. As prince of Yen, with a large personal following in the region of modern Peking, he forcibly took the Ming throne from a nephew in 1402. The Yung Lo (Yongle) emperor ruthlessly punished officials who had opposed his insurrection, centralized authority firmly in his own hands, and in 1421 transferred the capital to Peking, a newly rebuilt imperial city at the site of the Mongols' Khanbalik. He repeatedly campaigned in person against the resurgent Mongols to the north, incorporated Annam (northern Vietnam) into the Ming Empire, and from 1405 dispatched a series of great armadas, chiefly under the eunuch admiral Cheng Ho, to bring back tribute from as far away as Java, India, the Persian Gulf, and East Africa.

Under Yung Lo's imperial sponsorship, scholars completed the *Yung-lo ta-tien*, a monumental edition of extant literary, historical, and philosophical writings. The emperor died in August 1424 while returning from one of his expeditions into Mongolia.

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**YÜNNAN**, yün'nān', a province of southwestern China, bounded on the south by Vietnam and Laos and on the west by Burma. The province covers 152,000 square miles (394,000 sq km). A fourth of Yünnan's population is made up of some 30 non-Chinese nationality groups. They live for the most part in self-administered areas, chiefly in the west and south. Yünnan's total population was reported in the 1982 census as 32,553,817.

Kunming, the provincial capital, lies in the more densely settled eastern part of the province. It is Yünnan's chief industrial center and only large city, with a population (1980 est.) of 1,950,000. Three other cities have municipality status: Koku, a tin-mining center in the southeast, near the Vietnam border; Tungchwan, a copper-mining center in the northeast; and Siakwan, a regional transportation hub in the west, on the Yünnan-Burma Road, near Tali, a town famous for its marble quarries.

**Physical Features.** Yünnan can be divided into two distinct regions. The land east of the Red (Yüan) River is an integral part of the broad Yünnan-Kweichow Plateau. This eastern region contains many lakes. Elevations average 3,000 to 6,000 feet (900–1,800 meters) and are generally about 2,000 feet (600 meters) higher than the Kweichow portion of the plateau, which is farther east.

The mountainous western part of Yünnan is an extension of the Tibetan Highlands. It includes several parallel mountain chains that run generally from north to south, with elevations decreasing southward from 12,000 feet (3,650 meters) to 6,000 feet (1,800 meters). These mountain chains, collectively referred to as the Hengwan Mountain Range, delimit the courses of major rivers that flow southward through sharply etched canyons. The Salween (Nu), Mekong (Lantsang), and Red rivers continue into Southeast Asia, but the Yangtze turns eastward and marks part Yünnan's northern border on its way through the center of China.

The name Yünnan means "south of the clouds," a reference to the Yünlung Shan, or Cloudy Mountains, in the northwest. The province has a nearly uniform climate in the east, but temperatures vary markedly in the west, chiefly because of the sharp contrast of high mountains and steep canyons. The average temperature at Kunming ranges from 48° F (9° C) in January to 73° F (23° C) in July. At Tengchung, in western Yünnan, the January temperature averages 27° F (–3° C) as against 69° F (21° C) in July.

**Agriculture and Forest Resources.** On Yünnan's eastern plateau grains are grown on small upland plains, on terraced hillsides, and in river valleys. Rice, maize, millet, and barley are the major summer crops; wheat and oilseed are produced during the winter. Other important crops include sugarcane, which is grown in the Nanpan River valley of southeastern Yünnan, and sweet potatoes, which are planted throughout the eastern agricultural area. The province produces significant quantities of soybeans and lesser amounts of tobacco, fruits, and nuts. Puerh, a county in the southwestern corner of Yünnan, exports to other parts of China a highly regarded black tea.

Western Yünnan, where coniferous trees thrive in the acidic dark-gray soils, has extensive but largely unexploited timber stands. The inadequacy of that area's transportation facilities retards the growth of forest industries.

**Mining.** Yünnan is noted for its great variety of minerals, particularly nonferrous metals. Its tin deposits rank among the world's largest, and the output of the leading tin center, Koku, accounts for a major part of China's production of that metal. Modernized and expanded mining of copper, lead, and zinc takes place in the Hweishan area of the northeast. The copper mine at nearby Tungchwan has been important since the 17th century. Other significant mining production is carried on near Kunming: coal at Ipinglang to the west and iron at Imen to the south.

Yünnan also produces antimony, tungsten, mercury, phosphorus, manganese, silver, gold, phosphates, and salt.

**Manufacturing.** Modern manufacturing is concentrated in Kunming. The city has copper and iron smelters and factories that turn out steel, machine tools, trucks, mining and agricultural machinery, electrical equipment, precision instruments, chemicals, textiles, and foodstuffs. Dozens of hydroelectric power plants have been built in the vicinity.

**Transportation.** Prior to 1949 the only significant rail line in Yünnan was the single-track Kunming-Hokow section of the Yünnan-Indochina Railway. Thereafter, new rail lines were constructed to link Kunming with Kweichow province to the west and Szechwan province to the north. The capital is also the Chinese terminus of the Yünnan-Burma Road, built during World War II. The city's airport handles domestic and international flights.

**History.** Although the Yünnan area had been under nominal Chinese suzerainty since the advent of the Chinese Empire in 221 B.C., the area's remoteness and the loyalties of the peoples to their local leaders prevented the Chinese from exercising any effective control over the area until Ch'ing times (1644–1912 A.D.). With the rise of the Ming dynasty in 1368, military-supported Chinese colonization was encouraged in eastern Yünnan, but the territory was



still administered by local leaders who were responsible to the central government. This *t'u-ssu* system of indirect rule was formalized during the Ming dynasty, but the Yünnan region was not thoroughly integrated into the Chinese administrative hierarchy until 1681. During World War II, Yünnan was a vital link in the communications between Chungking, Chengtu, Kweiyang, and Burma. In 1941 an Anglo-Chinese agreement was signed delimiting the Sino-Burmese border, and construction was begun on a railway between Kunming and Lashio, Burma. After occupying Lashio and closing the Burma Road in 1942, the Japanese advanced further into Yünnan Province to the headwaters of the Salween River and assumed control of Tengchung.

On Oct. 1, 1960, a boundary treaty, delimiting the Yünnan-Burma border, was signed by Burma and China, followed by a protocol signed in Peking on Oct. 13, 1961, which further defined the frontier agreed on in the 1960 treaty.

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**YUPANQUI PACHACUTI**, yōo-pāng'kē pā'chā-kōo-tē', or **YUPANQUI PACHACUTEC**, yōo-pāng'kē pā'chā-kōo-tēk', ninth Inca sovereign: r. 1438-1471. Second son of the Inca Viracocha, he saved his small nation from being overwhelmed by the Chancas and, having seized power from his brother Urco, founded an empire that he enlarged to include nearly all the present territory of Peru. His adopted title Pachacuti means "cataclysm" or "he who changes the world." Yupanqui was an able administrator, one of his most effective innovations being the transplantation of colonists (mitimaes) from one conquered province to another to prevent rebellion. He was the founder of the Inca state religion and developed a system of paternalistic government that kept his empire intact for almost 100 years. See also INCA.

**YURACARÉ INDIANS** or **YURAKARÉ INDIANS**, yōo-rā-kā-rā', a people living at the headwaters of the western tributaries of the Mamoré River, north of Cochabamba, Bolivia. They number close to 1,000. The Yuracaré are tropical-forest farmers who supplement their diet by hunting and fishing. Both men and women dress in bark-cloth tunics; the men's reach below the knee and are decorated with elaborate patterns applied with carved wooden stamps.

The Yuracaré are divided into two major bands, each consisting of a number of small independent family groups. They are predominantly monogamous, and marriage is within the local group. Social control is effected by formal duels, fought with arrows fitted with special points that wound but do not pierce deeply enough to kill. The Yuracaré language is not known to be related to any other.

JOHN HOWLAND ROWE.

**YUROK INDIANS**, yōo'rōk (from Karok word for "downstream"), a large and important North American Indian tribe of the Weitspekan linguistic family, living along the lower Klamath River and coastal California. They call themselves Olekwo'l, meaning "persons," a term used by many Indian tribes in referring to themselves. Until the entry of gold seekers about 1850, these

people had almost no contact with whites; at that time they numbered about 2,500. They were fortunate in living in an area that the whites did not particularly covet, and probably for this reason they have remained virtually unmolested even to the present time.

In stature, the Yurok are among the tallest of the California tribes; they are physically well built and have developed a culture pattern somewhat beyond that of their immediate neighbors. Together with the Karok and the Hupa, they seem to form a distinct ethnographic group, yet the three do not appear to be linguistically related. The Yurok lived off fish, primarily salmon and lamprey, supplemented by acorns and small game. Clothing was scanty, save for ceremonial costumes, which had elaborate feather ornamentation. Living in the midst of the great redwoods, the Yurok made extensive use of this resource for the construction of their plank houses and their one-piece canoes.

The Yurok were essentially a peaceful people, and such wars as are known were usually the result of individual clashes or occasional raids to avenge a wrong. The women, who tattooed themselves in the custom common to many parts of California, were excellent basketmakers and wove a wide variety of beautiful containers. One of the more characteristic articles was the woman's basketry cap, worn to protect the head against the tumpline of a burden basket. The Yurok were one of the more artistic of northern California peoples and developed ceremonialism to a high art, their decorations being effected by means of such articles as woodpecker feathers, abalone shells, wood, bones, and obsidian. Obsidian and dentalium shells constituted the Yurok currency, which had a standard of value widely understood and accepted. Purses for holding shell currency were made from elk antlers. Tobacco was grown for smoking, and a peculiar straight pipe, with steatite bowl, was used by the men.

Yurok religious beliefs were complex; basically, they centered around an annual ceremony designed to renew the world—a sort of New Year rite. Other ceremonies were the Jumping Dance and the White Deerskin Dance, during which great obsidian blades were brought out from safe-keeping and displayed for all to see. This was an extremely impressive event, somewhat equivalent to the modern custom of promenading at a formal dance, wearing all of one's most precious jewelry. Curative powers were vested in female shamans. There are fewer than 500 Yurok surviving today, most of them full bloods.

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**YVES OF BRITTANY**, év, brī't'an-ē, SAINT (sometimes Ives; Lat., Ivo), French lawyer and cleric, patron saint of lawyers: b. Kermartin, near Tréguier, Côtes-du-Nord, France, Oct. 17, 1253; d. Louannec, May 19, 1303. Son of Hélor, lord of the manor of Kermartin, he was educated in civil and canon law and in 1280 was appointed "official" (ecclesiastical judge) at Rennes. There he came to the attention of the bishop of Tréguier, who had him ordained priest in 1284, after which he was assigned to the rectories of Trédrez (1285) and Louannec (1292). A zealous defender and benefactor of the poor, he was canonized by Pope Clement VI in 1347. His feast day is May 19.

Z	EARLY NORTH SEMITIC I	PHOENICIAN I	EARLY HEBREW (GEZER) 𐤆						CLASSICAL LATIN Z
	CURSIVE MAJUSCULE (ROMAN) Z	CURSIVE MINUSCULE (ROMAN) z				VENETIAN MINUSCULE (ITALIC) Z		MODERN ROMAN z	

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The development of the letter Z is illustrated in the chart above, beginning with the early north Semitic letter. The evolution of the majuscule (capital) is shown at top; that of the minuscule (lowercase) at bottom.

Z, zē, Brit. zēd, the last letter of the English alphabet. Its prototype exists in the earliest Semitic scripts—Phoenician (c. 1200 B.C.), proto-Sinaitic (c. 1700 B.C.), the pseudohieroglyphic of Byblos (some three centuries earlier still) and in the Ras Shamra cuneiform of about 1500 B.C. It has not been identified in Egyptian hieroglyphic, although the much later Meroitic inscriptions (2d to 4th centuries A.D.) have a sign that is read z, but it has no relation to the Semitic signs. From the latter, called *zayin* in Hebrew, a name doubtfully interpreted as “weapon” (by others as “olive” or “balance”), came the Greek *zēta*, confused with *xei* (ξ) in some places, much as Greek *xenodochium* is sometimes now written in English with z instead of x. In Greek the symbol preserves its original numerical value (seven), and also in the Cyrillic (Slavonic) alphabet. The name of the letter, probably not from Semitic *sādē* (a different sound), seems to have been modeled on those of the two following letters, *eta* and *theta*.

Latin had no z-sound, except briefly from s between vowels on its way to becoming r, and therefore dropped z, putting the newly invented G (see that article) in its place. But Z existed in Etruscan and Italic scripts (in Oscan and Umbrian with the value ts). Oscan had the sound z, written at first s, but, following Latin in usage, later on as z; for example, *zicolom*, “day” (with z from *di*; compare Latin *dies*, also “day”). Greek ζ was properly dz, not zd or z. In fact, z was usually written s, as in *μῆζω*, “mix,” or in *Smýrna*. When z was reintroduced into Latin, in the 1st century B.C., it was restricted to Greek words (for example, *zona*, previously written *sona*), and in some old borrowings z never prevailed (for example, *μάζα* written *massa*, whence French *masse*, English *mass*).

The Latin name of the letter is given as *zēta* by Ausonius, and this appears in Old French as *zēde* or *zé*, of which the former is still in use and has been borrowed into English (sometimes in the corrupt form *izzard*), though *zee* (from *zé*) has now become the usual name in the United States. Old English has z rarely, in late loan-words and with the value ts; the sound did exist but was written s (for example, *bosm*, “bosom,” *nosu*, “nose,” precisely like modern English spelling). In late Latin, both *gi* and *di* became z by the end of the Empire and thus became confused both with one another and also with i between vowels, and we get *oze* for *hodie*, “to-day,” and *zaconus* (*diaconus*), *zunior* (*tunior*), and even contrariwise *baptidare* for *baptizare*. This evidence indicates two pronunciations, a

popular y-sound and a cultured dz-sound. Different stages in the development appear in English in such spellings as *ielous* and *gelous* in John Wycliffe, now *jealous*, in contrast with the much later learned form *zealous*, with a different meaning, from late Latin *zelosus*. Further, z is used for the voiced form of s (*sh*), for example in *seizure*—a sound also written s (*leisure*); *si* (*decision*); *ti* (*position*); *xi* (*crucifixion*, *genuflexion*) where the Latin supine had x (*fixum*, *flexum*), *cti* otherwise (*restriction*, from Latin *strictum*), now common in *connection*, and even *g* (*rouge*). The French *cedilla* (*cédille*), as its name “little z” indicates was originally z (Z), now conventionalized as ç but pronounced s (for example, *façade*, *reçu*). The use of 3 in the meaning “ounce” in apothecaries’ measure, like the modern abbreviation *oz*, comes from the 15th century Italian *onza* (and this from Latin *uncia*), written *ōz*.

JOSHUA WHATMOUGH

Further Reading: See the bibliography for ALPHABET.

**ZAANDAM**, zān-dām', city, the Netherlands, in North Holland Province, on the Zaan River near its junction with the North Sea Canal, six miles north-northwest of Amsterdam. It is the center of the Zaanstreek industrial area and has lumber and dye industries. The picturesque Zaan district is intersected by narrow canals with individual boat docks attached to most of the houses. Emperor Peter I the Great of Russia worked here in 1697 in the shipyards, which at that time were a major industry in Zaandam. Pop. (1970) 63,500.

**ZAB RIVER**, Great, zāb (anc. Lycus), rivēr, Turkey and Iraq, rising in the Hakāri Mountains in Turkish Kurdistan. Its upper course is southeast for 115 miles in Turkey, after which it crosses into Iraq and continues south for 150 miles, entering the Tigris 25 miles south of Mosul.

The LITTLE ZAB RIVER (anc. CAPRUS) rises in Azerbaijan, Iran, and flows 250 miles southwest, joining the Tigris 75 miles southeast of Mosul.

**ZABRZE**, zāb'zhē, city, Poland, in Katowice Province, 11 miles west-northwest of Katowice. Situated in the rich coal and iron area of Silesia, it is a rail, coal-mining, and steel-milling center. Manufacturers include machinery, chemicals, and glass. Zabrze was founded in the 13th century and incorporated into Prussia in 1742. It was renamed Hindenburg in 1915 in honor of Field Marshal Paul von Hindenburg. The city was returned to Poland in 1945. Pop. (1970) 197,200.

**ZACAPA**, sā-cá'pā, department, Guatemala, 1,039 square miles in area, in the eastern part of the country, on the Honduras border, in the Motagua River valley between the Sierra de las Minas on the north and the highlands in the south. It is an agricultural area, with corn, yucca, coffee, sugarcane, and tobacco as the chief products. The city of Zacapa (pop. (1964), 30,187) is the capital and chief commercial center of the department. Pop. (1968) 107,000.

**ZACATECAS**, sā-kā-tā'kās, state, Mexico, on the great central plateau, about 28,122 square miles in area, bounded north by Coahuila, east by San Luis Potosí, south by Aguascalientes, south and west by Jalisco, and west by Durango. The Sierra Madre Occidental runs diagonally northwest to southeast across the state, giving it an average altitude of 7,500 feet. There are plains in the north, and temperate, moderately rainy valleys in the south. Much of the land is desert where only mesquite, maguey, and cacti can grow. The southern forests have been overexploited except in inaccessible regions still covered with ilex, copal, and other timber. Most of the rivers are tributaries of the Río Grande de Santiago, which empties into the Pacific Ocean. Mining has been important since colonial times, the chief riches being silver, gold, copper, and lead; the main mining centers are Zacatecas, the capital; and Fresnillo, Mazapil, Concepción del Oro, Sombrerete, and Ojocaliente. Cattle and sheep are also raised, and Zacatecan mules are famous for their endurance. Pop. (1970) 951,462.

IRENE NICHOLSON

**ZACATECAS**, city, Mexico, capital of the State of Zacatecas (see **ZACATECAS**, state), situated in a ravine 8,050 feet above sea level, in the midst of the rugged Sierra Madre Occidental. The town is built in typical highland fashion with steep, narrow streets, often with flights of stone steps. It is surrounded by six spectacular peaks, including El Grillo and La Bufa, the latter with a rock escarpment slashed in brilliant colors.

Zacatecas was founded in 1548 by Juan de Tolosa, who had discovered rich silver deposits nearby on land inhabited by the Zacateco Indians. Tolosa was joined by Cristóbal de Oñate, Diego de Ibarra, and Baltazar Termino de Bañuelos, and the four became perhaps the richest men in Mexico. The city received its royal charter in 1588. By 1832 the rich silver mines had produced bullion valued at 667 million pesos; but as the importance of silver diminished, the city also declined. It has, however, remained of strategic importance. In 1914 Francisco (Pancho) Villa won a battle here, celebrated in the popular *Marcha Zacatecas*.

Zacatecas has many fine colonial buildings, including the Municipal Palace and Law Courts; the Cathedral (begun in 1612) with its beautiful churriqueresque portico and life-size figures of Christ and the Apostles; and the Church of Santo Domingo (begun in 1746), a fine example of Spanish baroque. On La Bufa is located the Chapel of Los Remedios, a pilgrimage shrine of the Huichol Indians of the district. Pop. (1970) 50,251.

IRENE NICHOLSON

**ZACCHEUS**, zā-kē'as, in the New Testament, the chief publican (tax collector) of Jericho, and the subject of an incident related in Luke 19: 1-10.

In order to see Jesus, who was surrounded by a great throng, Zaccheus climbed a sycamore tree. Jesus bade him "... come down; for today I must abide at thy house." This evoked murmurs from the crowd that Jesus had gone in to lodge with a "sinner." Tradition states that Zaccheus gave up his riches, became a companion of the Apostle Peter, and eventually was appointed bishop of Caesarea.

**ZACHARIÄ VON LINGENTHAL**, tsä-khä-rē'ä fön līng'en-täl, Karl Salomo, German legal scholar; b. Meissen, Germany, Sept. 14, 1769; d. Heidelberg, March 27, 1843. After studying jurisprudence at Leipzig and Wittenberg, he was appointed professor of law at the latter university, where he taught from 1798 to 1807, and held the same position at Heidelberg from 1807 until his death. He was active politically as a conservative member of the Baden Parliament from 1820 to 1829. His writings cover practically every branch of jurisprudence, dealing with Roman canon, German, English, and French law, and opened up new fields in legal literature.

KARL EDUARD ZACHARIÄ VON LINGENTHAL (1812-1894), his son, was also a prominent legal scholar, who traveled widely in Europe and the East, making exhaustive researches in Roman and Byzantine law. He was the author of *Jus Graeco-Romanum* (1856-84), a seven-volume work on the sources of Byzantine law.

**ZACHARIAS**, zāk-ə-rī'as, in the New Testament, the father of John the Baptist and husband of Elisabeth. A priest in the Temple of Jerusalem, he was stricken dumb for refusing to believe the announcement, made by the angel Gabriel, that a son would be born to him and Elisabeth. He recovered his speech at the circumcision of the baby (Luke 1:5-79).

**ZACHARIAS**, Old Testament prophet. See **ZECHARIAH**.

**ZACHARIAS** or **ZACHARY**, zāk'ə-rē, SAINT, pope: b. Calabria, Italy; d. Rome, March 752; r. 741-752. Of Greek parentage, he succeeded St. Gregory III as pope in 741. Zacharias exercised a powerful influence over Liutprand, king of the Lombards, whom he induced to return four cities and the environs to the papacy. He also confirmed the deposition of Childeric III of the Merovingian dynasty as king of the Franks and the elevation of Pepin the Short to the Frankish throne (751). He convened two synods in Rome (743, 745) and addressed important letters to the Byzantine emperor Constantine V, condemning his iconoclastic policies.

**ZACHARIAS RHETOR**, zāk'ə-rī'as rē'tar (known also as **ZACHARIAS SCHOLASTICUS**), Greek historian of the Christian Church: fl. 535. A native of Palestine, he studied at Alexandria and Berytus (Beirut, Lebanon), practiced law in Constantinople, and became bishop of Mytilene. Four books, treating the period 450-491, survive in a Syriac version of his *Ecclesiastical History*.

**ZACHARY**, SAINT. See **ZACHARIAS**, SAINT.

**ZADAR**, zā'dār (It. **ZARA**), town, Yugoslavia, in the Dalmatian region of Croatia, on the Adriatic Sea, 72 miles northwest of Split. It is situated at the tip of a peninsula and is separated by the Zadar

Channel from the islands of Ugljan and Pašman, and possesses a fine, natural harbor. Zadar's chief industries are shipbuilding, liqueur manufacture, and food processing, especially the canning of fish. It is also a tourist center.

Zadar has had a turbulent history. About 100 B.C. the Romans occupied the Liburnian town of Iader and renamed it Jadera (the sail). The town was spared during the invasions of Dalmatia by the Avars and Slavs early in the 7th century A.D., and soon afterward it was occupied and made the capital of Dalmatia by the Byzantine emperors. The Croats took the town in 923 but were forced to abandon it to the Venetians before the end of the 10th century. After reverting to Croatian rule (about 1100), it was sacked by the Crusaders (1202) and turned over to Venice. It was subsequently conquered by the Croat-Hungarian kingdom but was sold back to Venice in 1409. After the dissolution of the Venetian Republic by the French in 1797, Zadar was incorporated into the Illyrian Provinces. In 1813 it was obtained by Austria along with the rest of Dalmatia, and it remained under Austrian rule until 1918, when it was captured by the Italians during World War I. The Treaty of Rapallo (1920) confirmed Italy's title. On Nov. 1, 1944, during World War II, the town was captured by Yugoslav forces and awarded to Yugoslavia by the peace treaty with Italy signed in Paris on Feb. 10, 1947.

The town contains important architectural monuments of the Middle Ages and the Renaissance. Notable are the Church of St. Donato (early 9th century), which is now a museum, and the Basilica of St. Anastasia (13th century), decorated with paintings by Jacopo Palma. Pop. (1965) 31,000.

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**ZADOKITE FRAGMENTS.** See GENIZAH.

**ZAFARIN ISLANDS.** See CHAFARINAS ISLANDS.

**ZAGAZIG**, zāg'ā-zīg (Ar. ZAQAQIQ), city, Egypt, capital of Sharqiya Province, on the Nile Delta and the Ismailia Canal, 47 miles north-northeast of Cairo. It is connected by rail or canal with the major cities of the Nile Delta and is a cotton and grain market. Two miles southeast are the ruins of the ancient city of Bubastis, now called Tell Basta. Pop. (1970) 173,000.

**ZAGHLUL PASHA**, zāg-lōōl' pa'shā, Sa'd (Ar. SA'D ZAGHLUL BASHA), Egyptian statesman: b. Ihyannah, Egypt, ?1857; d. Cairo, Aug. 23, 1927. Of wealthy peasant origin, he was educated in religious schools and at the Muslim university of al-Azhar. In 1881 he wrote for the official gazette *al-Waqā'i' al-Misriyah* but was jailed for complicity in the Arabi revolt after the British occupation in 1882. Zaghlul was soon released, however, and began to practice law. In 1906 the 1st early of Cromer, the British consul general who actually administered Egypt, chose him minister of education, and in 1910 he was made minister of justice.

During all this period, to the end of World War I, Zaghlul's reputation as a nationalist leader was growing, and on Nov. 13, 1918, he led a delegation to the British high commissioner demanding Egypt's complete independence. This event marks the birth of Egypt's first mass party, the Wafd (Ar. for "delegation"). When the

British refused Zaghlul's request and in 1919 deported him to Malta, revolution swept Egypt; Zaghlul was released and proceeded to the Paris Peace Conference and to London to plead Egypt's cause. After his return home, there was still no settlement, and new disturbances began. The 1st Viscount Allenby, now high commissioner, deported Sa'd to the Seychelles but also put pressure on London that resulted in a declaration of nominal Egyptian independence (February 1922). Released in 1923, Zaghlul plunged into the electoral campaign that was taking place under the newly promulgated constitution. A Wafd landslide resulted, and Zaghlul became prime minister (1924). His immediate goal was further British concessions. When negotiations failed, serious Wafdist-led disorders reerupted; British reaction was strong, and Zaghlul resigned. New elections (1926) produced another Wafd majority, but the British vetoed Zaghlul for the prime ministry. His colleagues elected him president of the Chamber of Deputies, and he held this post until his death. He was revered by the masses of his compatriots as the father of his country.

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**ZAGREB**, zā'grēb (Ger. AGRAM), city, Yugoslavia, capital of Croatia, at the foot of Zagreb Mountain (Medvednica), near the Sava River, 230 miles west-northwest of Belgrade. It is the second largest city in Yugoslavia and a chief center of light industry, producing carpets, leather

The Croatian National Theater in Zagreb. The city is the principal Croatian cultural center.

JAMES MASON/BLACK STAR



goods, wood products, and textiles. After World War II electrical and chemical industries were developed on a large scale. Zagreb is connected with Belgrade by highway and railroad and is an important point on routes leading from central Europe into the Balkans and from the Danube River to the Adriatic Sea. There is a large modern airport. The city is also a financial center, and periodic international fairs are held here.

Site of an old Roman settlement, Zagreb first became prominent in 1091 when King Ladislas I of Hungary established a bishopric here. After being ravaged by the Mongols in 1242, it was rebuilt and became a royal free city under the Hungarian crown, and from the second half of the 13th century was the chief town of Croatia and Slavonia. When the Austro-Hungarian monarchy was reorganized in 1867, Zagreb was made the capital of autonomous Croatia and the seat of the Croatian Diet (Sejm). After World War I, when the new Kingdom of Yugoslavia, including Croatia, was formed, the city lost its status as a capital; but it served during World War II as the capital of the Independent State of Croatia, headed by Ante Pavelić, and remained the capital of the Croatian republic in the reconstituted Yugoslav state after 1945.

Zagreb is the main center of Roman Catholicism in Yugoslavia, and possesses a fine 17th century Gothic cathedral and an 18th century archiepiscopal palace. For centuries, it has been the principal Croatian cultural center. Among its institutions are the University of Zagreb (see ZAGREB, UNIVERSITY OF), academies of music,

fine arts, and applied arts, the Yugoslav Academy of Sciences and Arts, and the Rudjer Bosković Institute for nuclear energy research. Population: (1981 census) 649,586.

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**ZAGREB**, ză'grěb, **University of**, a coeducational institution of higher learning in Zagreb, Croatia, Yugoslavia, with branches in Zadar, Rijeka, Split, and Osijek. It comprises faculties of law, economics, philosophy, natural sciences and mathematics, medicine, veterinary medicine, pharmacy, architecture, technology, agriculture, forestry, mechanical and naval engineering, and others. The university, chartered under its present name in 1869 and opened in 1874, grew out of the Jesuit Academy (chartered 1669), the Royal Public School for political and financial sciences (founded at Varaždin in 1769), and a Royal Academy of Sciences (1776). In the 19th century it played an important role in the Croatian national revival. Its library is particularly rich in Croatian literature.

**ZAGROS MOUNTAINS**, zăg'rās, mountain range, Iran, in the western and southern part of the country, extending 1,000 miles (1,600 km) south and east from the "Armenian knot" to the Persian Gulf. The range varies in width from 100 to 200 miles (160–320 km), and many elevations exceed 10,000 feet (3,000 meters), with Zardeh Kuh at almost 15,000 feet (4,500 meters) the highest, and Dinar Kuh and Kuh-i-Rang nearly as high.

The Zagros are basically calcareous and in their central and southern regions are formed primarily by folding. In the north they are mainly faulted, with large upthrust blocks giving the appearance of a plateau; numerous volcanic cones occur along the fault lines.

In winter, snow covers the peaks, giving way in spring to alpine meadows. Only small forested areas remain at higher elevations, while the lower flanks support only scattered herbaceous vegetation. One of the world's most productive oilfields is found in the foothill region to the west, occurring in the broad limestone anticlines at the fringe of the uplift.

The most important group inhabiting the Zagros are Kurds. Seasonal migration to graze sheep and goats (to the upland meadows in summer and to the lowlands in winter) dictates the Kurds way of life. In the northwest, around Lake Urmia, is an important wheat-producing area.

**ZAHARIAS**, za-hə-rī'əs, **Babe Didrikson** (1914–1956), American athlete. Mildred Ella Didrikson was born in Port Arthur, Texas, on June 26 1914. The daughter of Norwegian immigrants she was raised in Beaumont, Texas. She began her sports career in basketball with an insurance company team and was named an all-American in 1939–1941.

In 1932 she gained national acclaim by winning 8 of 10 events in the Amateur Athletic Union's national women's track and field championships, including the 80-meter hurdles, baseball throw, shotput, broad jump, and javelin throw. Later that year at the Olympic games she set two world records—the javelin throw (142 feet 4 inches, or 43.68 meters) and the 80-meter hurdles (11.7 seconds).

After the 1932 Olympics, Miss Didrikson became a professional athlete and spent the next

The Roman Catholic Cathedral of St. Stephen in Zagreb was built in Gothic style in the 17th century.

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AP/WIDE WORLD

Babe Didrikson Zaharias excelled in many sports.

years playing basketball and baseball, excelling as well in billiards, swimming, diving, and other sports. In 1938 she married George Zaharias, a professional wrestler. She started her championship record in golf in 1940 and won every available women's title at least once during the next decade. In 1950 she was chosen by an Associated Press poll as the outstanding woman athlete of the first half of the 20th century. She was stricken with cancer in 1953 and died in Galveston, Texas, on Sept. 27, 1956. Her autobiography, *This Life I've Led*, appeared in 1955.

**ZAHAROFF**, zə-hä'rōf, **Sir Basil** (1850?-1936), international armaments salesman and financier. He was born in Constantinople (Istanbul), Turkey, on Oct. 20, 1850, or in Mugla, Turkey, on Oct. 6, 1849. The son of a Russian (or Greek) father and Greek mother, he has been called the "mystery man of Europe," and the events of his life have been obscured by fable or design. About 1875 he became the representative in the Balkans of the munitions firm of Torsten Wilhelm Nordenfeldt; he was later associated in turn with the firms of Hiram Stevens Maxim and Vickers, and became one of the world's most successful armaments salesmen. Critics have attributed his immense wealth to political intrigue and the sale of munitions to both sides before and during wars. He eventually became a British subject and was knighted in 1918 for his services to the Allies in World War I. He died in Monte Carlo, Monaco, on Nov. 27, 1936.

Zaharoff was an intimate of many leading European statesmen, including David Lloyd George, Georges Clemenceau, Aristide Briand, and Eleutherios Venizelos. In his later years, he acquired substantial interests in petroleum, banking, and shipping, and was reputed to be an owner of the gambling casino at Monte Carlo. He was lavish in his philanthropies.

**ZÄHRINGEN**, tsä'ring-on, a dynasty of German rulers, named after the ancient village and castle of Zähringen, now part of Freiburg, in the state of Baden-Württemberg, in southwestern West Germany (Federal Republic of Germany).

The elder line temporarily gained possession of the duchy of Carinthia and Mark Verona in 1061 and ruled western Switzerland after 1152. This line expired in 1218. The members of the younger line called themselves margraves of Baden from the 12th century onward. Their territories were split in 1535 between a Baden-Baden and a Baden-Durlach line.

Among the rulers of the Baden-Baden line, who were Roman Catholics, Margrave Louis William I (reigned 1677-1707) gained great distinction in the Turkish wars of the 1680's. In Baden-Durlach, where the rulers became Lutherans, Margrave Charles Frederick (reigned 1738-1811) won a high reputation as one of the most enlightened European princes. In 1771 he inherited Baden-Baden also, and the demise of the Holy Roman Empire gave him, with the French Emperor Napoleon I's approval, additional territories beyond his old patrimony. Among these were the Austrian Breisgau and the sections of the Rhenish Palatinate on the right bank of the Rhine, including Heidelberg and Mannheim. In 1806 this enlarged Baden became a grand duchy, under Charles Frederick. From 1814 to 1866 it belonged to the German Confederation.

During the 19th century the Zähringen rulers were the most liberal of the German dynasts. They gave the state a constitution in 1818, and Frederick I (reigned 1856-1907) played an important part in German unification. Maximilian (Prince Max), the heir presumptive to the Baden throne, as chancellor of the Reich in October-November 1918, democratized the German constitution and conducted the negotiations for an armistice with the Allies. The last grand duke, Frederick II, abdicated after the revolution of November 1918.

See also **BADEN**.

**Hajo Holborn**

Author of "A History of Modern Germany"

**ZAIBATSU**, zī-bāt-sōō, industrial or financial combines in Japan. The great zaibatsu firms include Mitsui, Mitsubishi, Sumitomo, and Yasuda. See under **ANTITRUST LAWS**.

**ZAÏMIS**, zä-ē'mēs, **Alexandros** (1855-1936), Greek premier and president. He was born in Athens on Oct. 28, 1855, and educated at the universities of Athens, Heidelberg, and Paris. In 1885 he was elected to Parliament. After serving as minister of justice (1890-1892), he was premier in 1897-1899 and held this office again for brief periods in 1915, 1916, and 1917.

Both Zaïmis and his rival Eleutherios Venizelos, the Cretan political leader, favored Greece's entry in World War I on the side of the Allies. When King Constantine I, who was impressed by Germany's military power, insisted on neutrality, Venizelos formed a separate government in Salonika. Zaïmis, however, sided with the king. When Constantine abdicated under Anglo-French pressure in 1917, Zaïmis resigned as premier in favor of Venizelos.

After Greece became a republic in the 1920's, Zaïmis was elected president in 1929 and reelected in 1934. He died in Vienna, Austria, on Sept. 15, 1936.



AGENCE ZAIREPRESSE

Kinshasa, the capital of Zaire, is one of the largest cities in tropical Africa. It is situated on the Zaire River, at the point where freight from the interior must be moved by road or rail around falls to a seaport.

**ZAIRE**, zä-ër', a country in Equatorial Africa. It occupies most of the basin of the Zaire River, which is still known outside of Zaire as the Congo River. Formerly a Belgian colony called the Belgian Congo, the nation achieved independence on June 30, 1960, and adopted the name Republic of the Congo. The formal designation of the country was changed to Democratic Republic of Congo on Aug. 1, 1964. The country was frequently referred to, in conjunction with its capital, as "Congo (Kinshasa)" to distinguish it from the neighboring People's Republic of the Congo, or "Congo (Brazzaville)."

peoples live only on the northern and eastern fringes, mostly as "spillovers" from the neighboring northern and eastern states—the Central African Republic, the Sudan, Uganda, Rwanda, and Burundi.

Distribution of population is uneven, with the greatest concentration occurring along the edge of the equatorial forest, which covers most of the semicircular area encompassed by the Zaire River. Thus population density is highest in the areas south of the Zaire-Kasai-Sankuru river system and along the eastern border of the country.

**Society.** Semisedentary agriculture characterizes the way of life of the people of Zaire. Depending on the environment in which agriculture is practiced, the traditional economies of Zaire are of two basic types. In the tropical rain forest, farming is practiced in clearings made by relatively small groups of people. Therefore,

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The Democratic Republic of Congo changed its name to the Republic of Zaire on Oct. 27, 1971. The new name was taken from the name given by Portuguese explorers to the Congo River, based on an approximate rendering of the KiKongo word *nzadi* ("river"). In French, the name takes a diaeresis: Zaire.

#### 1. The People

Ethnically, Zaire is more homogeneous than many countries in Africa. All of its inhabitants except the Pygmies belong to the group identified by the anthropologist George Peter Murdock as Melano-Africans. 90% of them fall into the "Congolese" subcategory. Sudanese and Nilotic

#### INFORMATION HIGHLIGHTS

**Area:** 905,563 square miles (2,345,409 sq km).  
**Boundaries:** North, Central African Republic and Sudan; east, Uganda, Rwanda, Burundi, and Tanzania; south, Zambia and Angola; west, Atlantic Ocean, Angola, and Congo.  
**Elevations:** Highest—Margherita Peak (16,762 feet, or 5,109 meters); lowest—sea level.  
**Population:** (1984 census) 29,671,407.  
**Capital and Largest City:** Kinshasa.  
**Name of Nationals:** Zairians.  
**Major Languages:** French (official), LiNgala, KiSwahili, KiKongo, and CiLuba.  
**Major Religious Groups:** Roman Catholics, Protestants, Kimbanguists, and followers of traditional African religions.  
**Monetary Unit:** Zaire (= 100 makuta).  
 For Zaire's flag, see under FLAG, both illustration and text.

the farming community is usually small, always close-knit, and often isolated. In the savanna, on the other hand, farming can be practiced on a wider scale by larger communities. While the difference in output between the two types of farming is not considerable, there is a wide socio-political gap between the two types of economy. In the tropical rain forest, kinship ties and village political organization remain so tightly intertwined as to be indistinguishable. Savanna agriculture, on the other hand, is just high enough above the subsistence level to be able to produce a surplus, and the administration of this surplus requires a more intricate form of political organization. The terrain also makes it possible for political authority to spread over a wider area in the savanna, and historically the territorial state appears. The difference between the two types of economy is so striking that they have been contrasted as "the civilization of the clearings" and "the civilization of granaries."

Class stratification in Zairian societies seldom reached the rigidity and economic inevitability apparent in societies like those of Rwanda or northern Nigeria. This was true even in those societies where role differentiation had reached some degree of complexity. Nor had subjugation

as a result of military conquest produced the military-bureaucratic patterns of northern Nigeria and the lacustrine (lake) kingdoms of East Africa. What social classes existed, such as courtiers, warriors, artisans, serfs, and slaves, became obscured with the advent of colonial rule. Socially, the European intrusions in the late 19th century resulted in a relative increase of mobility within the African societies and a relative obscuring of precolonial class distinctions as a result of the superimposition of a new economically privileged ruling class—the Europeans.

Urbanization and economic development produced a large mass of detribalized Africans who—without necessarily breaking entirely with the tribal society—were now in a position to attain wealth and status hitherto unavailable to them in their traditional environment. Traditional political organizations were weakened or even shattered by the drain on the adult male population and by Belgian administrative policy, which left little autonomy to the chiefs. On the eve of independence, nearly one fourth of the population was affected by urbanization—or rather by the process of detribalization.

Today about one half of the population lives in the urban centers of Zaire. Kinshasa (formerly





These Pygmies live in the Ituri Forest of northeastern Zaire. The Pygmies are quite distinct ethnically from the other Zairians, who have been classified as Melano-Africans.

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Léopoldville) is the capital and largest city of the country. The other major cities include Lubumbashi (formerly Elisabethville), Kisangani (Stanleyville), Kananga (Luluabourg), and Mbuji-Mayi (Bakwanga). Matadi, near the mouth of the Zaire River, is the country's major port.

**"Tribes."** The concept of the tribe is an elusive one—and particularly so in Zaire. Common misconceptions abound on this subject. Reference to Zaire's "200 tribes" is misleading because it overlooks a number of factors:

(1) Groups sometimes identified as "tribes" are in fact the agglomeration of a number of smaller groups. This is true of the BaLuba and, more specifically, of the BaKongo, who have reached their present state of "national consciousness" through a comparatively recent process. Factors such as the deliberate glorification of the former Kongo Kingdom, the catalytic role of a native sect (Kimbanguism), and a search for identity in the multiracial environment of Kinshasa all played a part in and were used by a political formation—Alliance des BaKongo (ABAKO).

(2) Groups bearing the same name can be quite different in language, shared experience, and even in kinship systems. Such is the case with the BaLuba of Kasai and Shaba (Katanga).

(3) What is commonly described as "inter-tribal" fighting often occurs between subgroups (such as clans) of the same "tribe."

(4) Groups that never had common political institutions may enjoy a sense of commonality or at least of "apartness" from other groups (the BaMongo).

Tribalism as it is known today, with its implications in terms of political affiliation, apportionment, appointments, patronage, and other political behavior, is mainly a product of the urban, and not of the rural, environment. The search for identity does not arise in the traditional environment, where each man is clearly inserted into his lineage, clan, and tribal patterns. When he moves to the city, the African is naturally led to seek association with members of his traditional environment. The significant factor about tribalism is that it acts as a protection for insecure men of the cities rather than as a tradition-rooted force.

Two factors furthered the trend toward urban tribalism. First, the housing patterns developed by the European colonizers "to avoid trouble" usually followed real or assumed ethnic patterns. Second, all those supposedly belonging to the same "tribe," regardless of finer distinctions, were often lumped together under a label by those apart from the group. This lumping together was eventually accepted by those who were labeled, if only for ease of communication or out of vague pride in belonging to a group assumed to be larger than it really was. It is notable that the smaller the number of one's compatriots in the city, the larger the group with which one seeks identification. Thus it was, and still is, common for people from the Kasai region to identify themselves as BaLuba (or even as BaKasai, which denotes regional, not tribal, origin) even if they were, in fact, members of a smaller, lesser-known group. Identification was made easier by the fact that the individual's real tribe and the one with which he sought to be identified, while different, probably had more in common than any other two groups. There may also have been a desire to identify with a group regarded as more prestigious, if only in the eyes of the Europeans.

**Language.** The vast majority of Zairians speak one of several Bantu languages, some of which are mutually intelligible and all of which have the same grammatical structure. Vehicular languages have evolved in several areas of the country. For example, LiNgala is used along the Zaire River, from Kinshasa to Kisangani, and throughout the country by the Zairian army. A form of KiSwahili sprinkled with local dialectal terms is used from the Ituri Forest region in the northeast down to Shaba. KiKongo is used in the Lower Zaire and Bandundu regions of the southwest, while CiLuba is used in Kasai. French, spoken by all educated Zairians is the official language of the country.

**Religion.** Traditional religions of the Zairian people are a complex blend of rites and beliefs overlying an implicit philosophy built around the concept of a "life force." Rites associated with the cult of ancestors or with passage are common throughout the area and help provide social and political cohesion. Beliefs usually refer to the

Housewives shopping in Kinshasa's biggest market. Life in Zaire, as in many other African countries, is a mixture of traditional customs and very modern Western practices.



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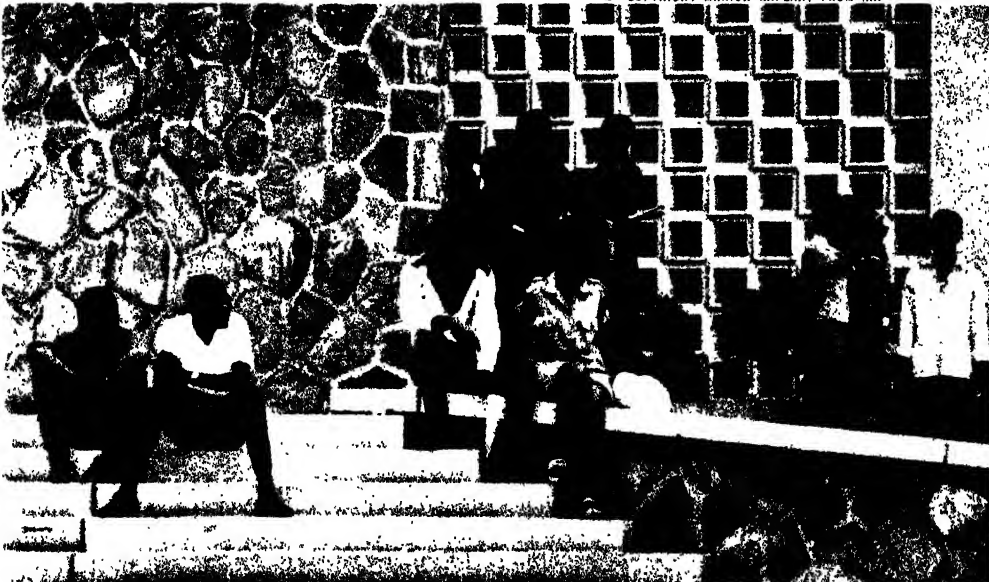
spirit world and reflect the human desire for "logical" explanations of illness, accidents, death, fertility (of the earth or of women), and success or failure in war, love, agriculture, and other human experience. Propitiation of all causal forces is sought by appropriate ritual, while divination is chiefly intended to uncover the person or persons who are exercising a nefarious influence.

For a large number of African converts, Christianity appears to have been indissolubly linked with Western colonial rule and with its claims of moral superiority, supported mostly by the material superiority, of European civilization. The adoption of Western religion was seen by many as instrumental to the securing of the power and wealth of Europeans. When this goal was not realized, various phenomena occurred, ranging from outright rejection of Christianity to the

development of dozens of native Christian sects expressing the African's yearning for a form of Christianity revealed through Africans. The most important of these sects are Kitawala, an offshoot of the Watch Tower (Jehovah's Witnesses) movement; and the Kimbanguist church (Church of Jesus Christ on Earth Through the Prophet Simon Kimbangu). Based on the brief pastoral career of Simon Kimbangu in the lower Congo area in 1921, the Kimbanguist movement survived persecution by the colonial and missionary authorities and emerged as a powerful cement of Bakongo national unity in the 1950's. In 1972 the government consolidated all Protestant denominations with the exception of the Kimbanguist church into a single organization, the Church of Christ in Zaire, thereby indirectly denying official existence to a large number of independent sects.

Students relaxing on the campus of the University of Kinshasa (formerly Lovanium University).

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HECTOR R. ACEBES, FROM PHOTO RESEARCHERS

Vegetation in Zaire's equatorial forest belt is lush. Stretching across the country, the belt is watered by the Zaire (Congo) River and its numerous tributaries.

Indigenous Muslims are few. Most are the descendants of East African coast traders of mixed Arab and African ancestry, who were operating in eastern Zaire during the 19th century.

## 2. Education

The Belgian Congo was notorious for its lack of a university-trained elite, but its recorded percentage of elementary school attendance—56% in 1959—was one of the highest in Africa. This figure was deceptive, however, because elementary schooling was limited in most cases to the first two grades. Fewer than 10% of the school-age children ever completed the six-year elementary cycle. Understandably, one of the chief efforts of the Zairian government has been to push as many schoolchildren as possible beyond the two-year cycle, which is virtually useless unless followed by further schooling.

Education remained, as it was before independence, a virtual monopoly of the Christian missions, although placed under the supervision of a government ministry. More than two thirds of all elementary-school children attend schools staffed by Roman Catholic missions, and another 25% attend Protestant or Kimbanguist schools. Physical hardship forced the discontinuation of several hundred "bush" schools during the mid-1960's, but many of them later reopened.

Only a limited number of secondary-school students are able to enter institutions of higher learning. In 1970, 60% of these students were enrolled at one of the country's three universities: Lovanium University of Kinshasa (Catholic), the State University at Lubumbashi, and the Free University of the Congo at Kisangani (Protestant). In 1971, however, these three universities were combined with other institutions of higher learning such as the National Institute of Mines, the National Pedagogical Institute, and the National School of Law and Administration, to form a single, nondenominational National University of Zaire (UNAZA). In 1981 the na-

tional university was reorganized as the separate universities of Kinshasa, Kisangani, and Lubumbashi.

## 3. The Land

Zaire is the largest country lying entirely within sub-Saharan Africa. Although its frontiers were drawn up around conference tables, Zaire has more "logical" boundaries than most new African states. The approximately 3,000-mile (5,000-km) course of the Zaire River, from headwaters to estuary, lies almost wholly within the territory of the republic, and the Zaire-Nile and Zaire-Zambezi watersheds demarcate most of the country's eastern perimeter.

**Geography and Climate.** The critical climatic feature in Zaire is the equatorial zone, which stretches across the entire country over an area approximately four degrees in latitude on either side of the equator. This climatic zone roughly coincides with the equatorial forest belt running from Uganda to the coast of Gabon. To the north and south of this belt lie two zones of tropical wet and dry climate with which park forest and savanna vegetation are associated. Because Zaire stretches from latitude 5° N to 13° S, the southern savanna belt is much more extensive than the northern one and the material cultures that grew up in this southern savanna have had greater historical significance for the country. Toward the southeast the savanna becomes increasingly wooded, and the climate changes from an alternating pattern of two wet and two dry seasons to that of one wet and one dry season. Finally, all along the Great Rift Valley, which forms the eastern border of Zaire, particular soil, rainfall, and elevation combine to form a narrow, highly distinctive geographical fringe zone.

With the exception of the southeasternmost corner of Zaire, rainfall is abundant throughout the country. It averages well over 40 inches (1,000 mm) annually and rises to more than 80 inches (2,000 mm) along the Great Rift Valley

and in the low-lying area delineated by the gigantic bend in the Zaire River. Around this central depression, known as the *cuvette*, which has an average elevation of 1,300 feet (400 meters), a succession of plateaus rises gradually to elevations of over 5,000 feet (1,500 meters) in the northeast and southeast. Highest elevations, however, are found along the Great Rift Valley. Here dislocation of the strata has produced important mountain masses, most notable of which is the Ruwenzori, with its highest peak rising to 16,762 feet (5,109 meters).

**Soil.** The soil of Zaire is generally poor. The topsoil is subject to erosion and to the formation of laterite crusts often spreading over huge areas. Laterite is the result of surface crystallization of iron oxides or aluminum hydroxides of such thickness as to preclude any significant form of agriculture. Since good soils are comparatively rare, overpopulation is common in the fertile areas. These are mainly strips of alluvial deposits along the Kasai River and its many tributaries, or volcanic soils of the Great Rift Valley, especially of the Kivu region.

**Animals and Plants.** Zaire's fauna and flora are among the richest and most varied in the world. An extraordinary number of species have been cataloged—many of them not found anywhere else. Zaire is the home of several "living fossils," or rare species, such as the okapi, the forest and mountain gorillas, the pangolin, and the African manatee. About 10,000 species of flowering plants have been found.

#### 4. The Economy

A country of vast and varied natural resources, Zaire probably has the greatest potential for economic growth in all sub-Saharan Africa. Indeed, many of its resources, such as hydroelectric energy and natural gas deposits, have yet to be fully tapped. The country's natural resources—particularly the minerals—are far from being evenly distributed. Moreover, their exploitation was generally carried out by other than native groups, with the indigenous population participating only indirectly in the process of economic development.

Furthermore, far from being coherent and continuous, Zaire's economic progress has gone through successive phases during which widely different forms of exploitation were emphasized. During the first 30 years of European occupation, a predatory economy based on ivory and wild rubber prevailed. This phase came to an end with World War I, partly as a result of humanitarian protests against the forced-labor system on which this type of exploitation was founded and partly because the exhaustion of the ivory supply and the development of rubber plantations in Southeast Asia made Congolese production less and less competitive. A more systematic effort toward the development of an efficient plantation economy was started after Belgium took over the Congo Free State in 1908. The fluctuations of the world market at the time, however, made it difficult for all but the larger rubber manufacturers, such as Unilever, to survive.

The mining industry, launched shortly before World War I, brought the colony its most spectacular and characteristic development. Even more than plantation farming, however, mining requires large investments and economic concentration. In addition, because the more important mineral deposits were found mostly in sparsely

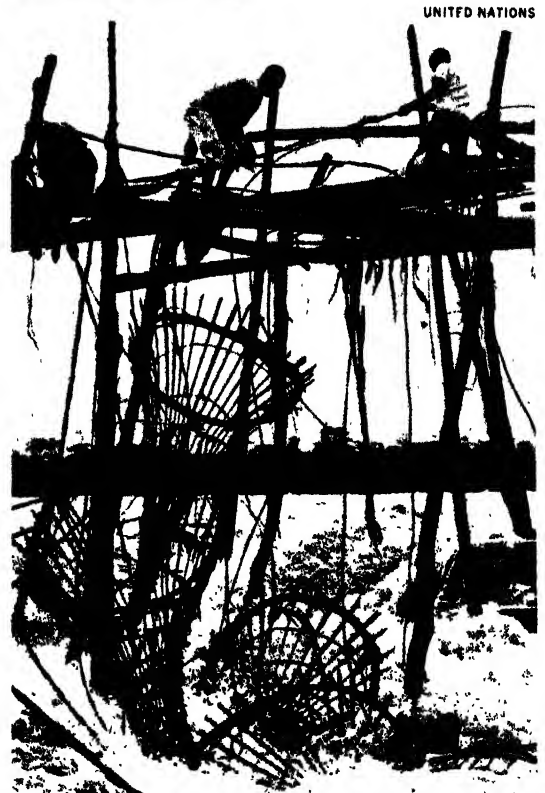
populated areas, their exploitation led to large-scale migration and urbanization, which in turn caused widespread disruption of indigenous agriculture.

**Agriculture.** The agriculture of the Zairians is based mostly on American crops introduced in the 16th century, such as cassava, maize (corn), sweet potatoes, and peanuts, or on plantain bananas, an earlier Asian import. Indigenous African crops such as pulses, millet, sorghum, and yams are also important. Traditional farming relies on methods such as brush burning, long-term crop rotation, and the use of the hoe, all of which are suited to the poor soil conditions but are not conducive to high productivity. Some cattle are grazed in the eastern highlands. Fishing, hunting, and goat and poultry raising add protein to the generally inadequate diet.

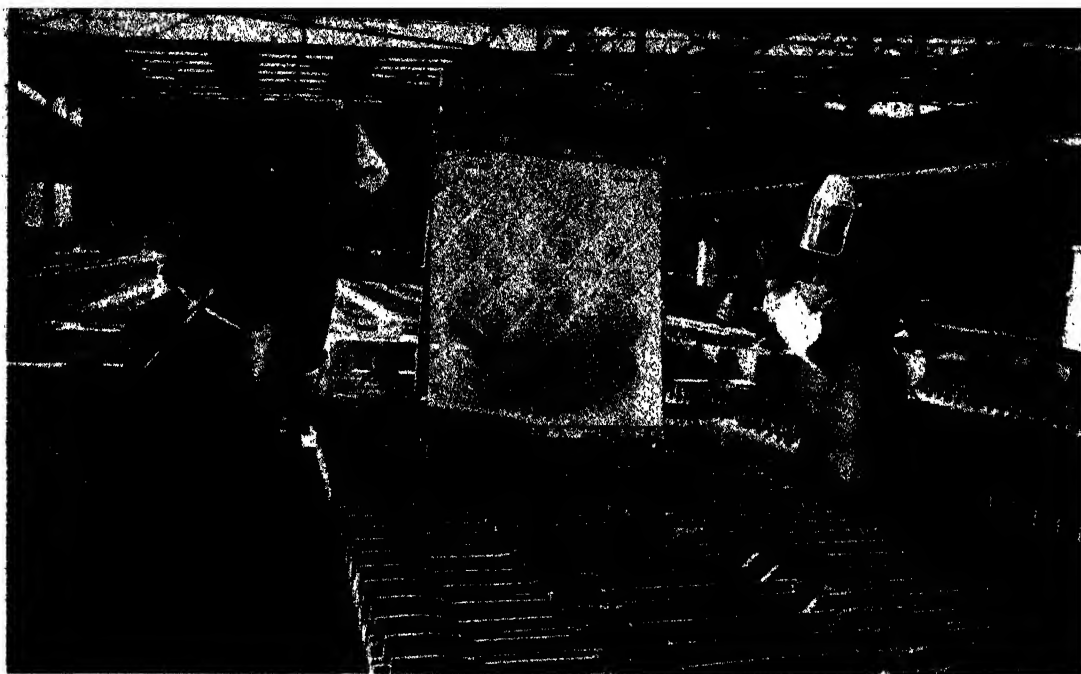
European colonization resulted in the development of marketable food and industrial crops. Indeed, the cultivation of such crops was made compulsory for traditional communities as early as 1917. The principal cash crops are coffee, palm products, cotton, rubber, tea, cocoa, and tobacco.

**Mining and Energy Production.** Mining, including oil extraction, is the mainstay of the Zairian export economy. With the exception of diamonds and oil, most of the mineral wealth is concentrated in the Shaba (formerly Katanga) region. Zaire is usually ranked first in world production of cobalt and industrial diamonds, and it is among the leading suppliers of copper. It also produces cadmium, gold, manganese, silver, tan-

Fishermen lower conical basket traps into rapids of the Zaire River near Kisangani to catch a species of fish that resembles European bass.



UNITED NATIONS



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A sheet of copper refined by electrolysis in the Shaba (formerly Katanga) region. Shaba is Zaire's copper belt.

talum, tin, tungsten, and zinc. Oil is tapped off the country's short Atlantic coastline. Sufficient quantities of coal were found in Shaba to fuel smelting operations until that source of energy was superseded by hydroelectric power on the upper Lualaba and Lufira rivers. But the most promising source of energy remains the huge Inga hydroelectric scheme, which was constructed on the lower Zaire River near Matadi.

**Manufacturing.** As in many developing countries, manufacturing in Zaire was initially limited to the processing of primary products. At a later stage, textile mills, breweries, and factories to produce such items as soap, shoes, and construction materials were set up. More recently mining companies sponsored the production, through subsidiaries, of chemicals, nails, wires, pipes, metal cans, and household articles. Other miscellaneous industries such as textiles and plastics production, automobile and bicycle assembly, and the manufacture of cigarettes and paints and varnishes have also been developed.

Partly because Belgian imports had been denied preferential treatment under international tariff agreements, manufacturing was always more developed in Zaire than in almost any other tropical colony. After independence, monetary instability acted as a spur for the manufacturing of consumer products that hitherto had been purchased abroad.

**Trade.** Zaire's chief exports are copper, crude oil, industrial diamonds, cobalt, and coffee. Principal imports include machinery, transportation equipment, petroleum products, chemicals, clothing, and foodstuffs.

Belgium has always been the chief buyer of Zairian products and usually has been Zaire's chief supplier of imports. Other Western European countries also are important trading partners of Zaire, as are the United States and Japan.

**Transportation.** From the day that the 19th century explorer Henry Morton Stanley remarked that the Congo without a railroad was not

worth a penny, transportation has been one of the country's major problems. Zaire has a vast inland water system, and the Belgians developed rail transportation primarily to supplement the available waterways. Therefore the only rail links along the middle and lower course of the Zaire River are two short lines that bypass the Boyoma (Stanley) Falls, near Kisangani, and the lower Zaire rapids. The major cities of Kinshasa and Kisangani owe their existence to the need for transshipment of cargo at these two critical locations.

The absence of navigable waterways in Shaba prompted the construction of a well-developed rail network. It connects this mineral-rich area with the Zairian seaport of Matadi, via the rail-ship-rail "national route" (using river transportation between Ilebo and Kinshasa) and, more directly, with the Angolan port of Lobito on the Atlantic Ocean and the Mozambican port of Beira on the Indian Ocean (by all-rail routes). A less important railroad connects the national route with Kalemie on Lake Tanganyika. Steamers on Lake Tanganyika provide a connection with the Tanzanian port of Kigoma, on the opposite shore, and an all-rail route extends from there to Dar es Salaam.

Zaire's 3,000 miles (5,000 km) of railroads and 10,000 miles (16,000 km) of navigable waterways are well adapted to the requirements of an export-oriented economy. But they are of limited use for the type of local development projects that the Belgians tried to promote.

Road construction, the obvious answer to the needs of rural development, was not well promoted before 1960. Zaire has only about 80,000 miles (145,000 km) of roads, and unrest in the country following independence resulted in serious deterioration of the existing road network. Aviation, on the other hand, has outpaced the development of surface transportation. The airplane is by far the most common means of passenger transportation for all but purely local trips.

## HISTORY AND GOVERNMENT

The Bantu ancestors of the present inhabitants of Zaire may have come from the southeastern portion of modern Nigeria. Most, if not all, of them had reached the Zaire Basin by about 800 A.D. and were equipped with the agricultural and metallurgical skills that were still in use when European rule was established more than 1,000 years later. Pygmy hunters and food gatherers, who were the original inhabitants, were forced to retreat to the more inaccessible parts of the region. During the second half of the 17th century, non-Bantu groups began to infiltrate the northernmost portions of the Zaire Basin.

### 5. The Congo to 1960

Several major states emerged to the south of the tropical forest belt between the 13th and 19th centuries. The best known was the Kingdom of Kongo, where the monarch embraced Christianity, invited Portuguese trade and technical assistance, and exchanged ambassadors with the courts of Lisbon and the Vatican. Internecine strife, incursions by the warlike Jaga, and conflict with the Portuguese wrecked the kingdom by the end of the 17th century. Thereafter, Kongo's superficial Christianity was engulfed by traditional religion.

Farther to the east the kingdom of the BaKuba deserves notice for its artistic achievements and for the continuity of its oral chronicles. The Songye, on the upper Lomami River, developed an urbanized civilization unique in this part of Africa. During the 1400's a Songye dynasty founded the Luba empire, which reached its height toward the end of the 18th century, when it covered most of modern Shaba. To the south, a modest confederacy of chiefs, which was founded in the late 16th century, developed into the far-flung Lunda empire. At its peak in the mid-17th century, this empire straddled the modern boundaries of Angola, Shaba, and Zambia.

Also in Shaba, an adventurer from Unyamwezi (in modern Tanzania) named Msiri built an ephemeral state during the 19th century. Ruling from his capital at Bunkeya, Msiri established a profitable commercial network. Msiri's state collapsed when he was killed by a Belgian army officer in 1891. In the northeast the most remarkable states were those of the Mangbetu and the Azande. In the eastern lake region, political organization was influenced by the neighboring kingdoms of Rwanda and Burundi.

**The Coming of the Europeans.** European penetration began with the discovery of the estuary of the Zaire by the Portuguese explorer Diogo Cam (Cão) in 1483. Soon the Portuguese made contact with the king of Kongo. During the next three centuries, traders and missionaries attempted to penetrate the interior by ascending the river, but seldom progressed beyond the site of modern Kinshasa.

Trading by Europeans in slaves brought from the interior developed gradually, reaching its peak in the Zaire Basin between 1800 and 1850, when some 150,000 slaves were shipped from this area each year. Arab slave trade expanded into the region after 1840, and by 1875 the annual shipment of slaves from Mombasa (in Kenya) and Zanzibar exceeded 55,000.

After 1850, European explorers such as David Livingstone, Richard Francis Burton and John Hanning Speke, Sir Samuel Baker, Georg

Schweinfurth, and Sir Donald Cameron reached the periphery of the Zaire Basin. But it was Henry Morton Stanley who first navigated the Zaire River from its upper course to the Atlantic Ocean from 1874 to 1877. He was then hired by Leopold II, king of the Belgians, who had sponsored the creation of an International African Association in 1876. Between 1878 and 1884, Stanley and others set up posts and signed protectorate treaties with local chiefs throughout the region, in the name of another group headed by Leopold. This was known as the International Congo Association.

**The Congo Free State.** Leopold II was recognized as sovereign of the Congo Free State at the Berlin Conference on Africa (1884-1885). During his rule, military expeditions evicted the Arab traders from the northeast, and a chartered company secured the occupation of Katanga (now Shaba). The Congo Free State was primarily an economic venture and had no institutional links with Belgium. Financial difficulties led to harsh economic exploitation, and mounting international criticism finally prodded Belgium into taking over the Congo Free State as a colony in 1908.

**Belgian Colonial Rule.** When the Belgian Congo colony was established, the practice of executive rule was continued. After setting up the ground rules of colonial government laid out in the Charte Coloniale of 1908, the Belgian parliament seldom bothered with African affairs. Legislation was enacted by executive decrees issued by the Belgian government in Brussels or, for matters of smaller scope, by the governors-general in Léopoldville (now Kinshasa). Thus the Congo was largely kept out of the mainstream of Belgian political life.

Despite official policy pronouncements favoring a form of indirect rule, traditional chiefs were incorporated into the administrative system principally as auxiliaries of the Belgian officials. Local government institutions—or indeed the very concept of local government—were totally lacking in the Belgian Congo before 1957.

The Belgians attempted to insulate the Congo from metropolitan political life and from the currents of African nationalism. Assuming that political aspirations might be minimized if social and economic needs were adequately met, Belgium promoted a policy of outspoken paternalism in which the administration, the religious missions, and the business circles concurred. Remarkable success was achieved in the fields of health and urban development, but opportunities for advanced education were sharply limited, and important civil rights were denied to the Africans. Permanent white settlement was not encouraged. But by 1959 the white population had grown to 115,157, most of whom lived in Léopoldville and in Katanga.

**Achievement of Independence.** Planned political change, beginning in the early 1950's, was initially aimed at developing a Belgo-Congolese community in the rather remote future. A lack of any real sense of urgency characterized these early speculations, the most "advanced" of which suggested a 30-year transitional period. The first signs of African restlessness did not appear until 1956, and it was only in 1958 that political pressure jolted Belgium out of its secure immobilism. The announcement in January 1959 of far-reaching political reforms came too late to forestall serious riots in the capital.

Mushrooming political parties, vying for recognition, criticized the unilateral character of the reforms and demanded a voice in the formulation of policy changes.

In December 1959, Belgium decided to grant independence within months. The decision was based on several factors, including the fear of businessmen that protracted political unrest might wreck an already ailing economy, the specter of the Algerian war, the deceptively successful example of de Gaulle's rapid decolonization of French tropical Africa, and the belief that an independent Congo would continue to depend heavily on Belgian administrators, technicians, and entrepreneurs. Provisions for the transfer of power and outlines of future political organizations were laid out by the Brussels Round Table Conference (January–February 1960). No single political party, however, won a majority in the preindependence election. Joseph Kasa-Vubu and Patrice Lumumba formed a coalition government and became respectively president and premier when the Congo became an independent republic on June 30, 1960.

## 6. The Search for National Unity

Within days, the new government's precarious control over the state apparatus was seriously compromised by a series of army mutinies and local disturbances. Seizing on this pretext, Moïse Tshombe, the provincial president of Katanga, backed by certain European elements, seceded from the republic on July 11, while Belgian troops were being dispatched to occupy key positions in the country. President Kasa-Vubu and Premier Lumumba asked the United Nations to help restore order, secure withdrawal of Belgian troops, and reunify the country. Angered by what he considered UN reluctance to accomplish these aims, Lumumba appealed for help to the Soviet Union, but he was dismissed and jailed by Kasa-Vubu on Sept. 5, 1960. The deposed premier fought for control with the backing of several Afro-Asian states, but was murdered in Katanga by his political adversaries in January 1961.

Vice Premier Antoine Gizenga attempted to succeed Lumumba and to set up a national government in Stanleyville (now Kisangani), but actual power in Léopoldville fell into the hands of the military under Joseph Mobutu.

Parliament reconvened under UN protection in July 1961 and on August 2 named Cyrille Adoula to head a cabinet of national reconciliation. Katanga persisted in its secession, however, and it was not until January 1963, after two earlier UN operations had failed, that the break-away province was forcibly reunited with the rest of the country.

**The Constitution of 1964.** In 1963 the increasingly deadlocked parliament was relieved of its responsibility for drafting a permanent constitution. The task was entrusted to a commission handpicked by President Kasa-Vubu, and the resulting document was declared to have been approved after a somewhat dubious referendum. The new constitution of Aug. 1, 1964, provided for an uneasy division of executive power between the president and the premier—a provision fraught with potential conflict. The structure of the state was made decidedly more federalistic than previously, but the central government retained important powers of intervention in provincial affairs.

Slow and painful reconstruction during 1963 was hampered by economic and administrative breakdown, clashes between radical nationalists and the military-bureaucratic oligarchy, labor unrest, and the ever-impending threat of civil war or secession. The growing disaffection of vast sectors of the rural population led to the outbreak in 1964 of a series of peasant revolts with strong messianic overtones. These were exploited by political radicals such as Christophe Gbenye, Gaston Soumialot, and Pierre Mulele, loosely linked in a group known as the Comité National de Libération (CNL). This committee was backed in turn by a number of African countries, including Egypt, Algeria, Congo (Brazzaville), and Burundi, while the USSR and China competitively intervened.

**The Tshombe Administration.** Premier Adoula was forced to resign in June 1964 and was replaced by Moïse Tshombe, who returned from self-imposed exile. Tshombe recalled the white mercenary units that had formed the military backbone of the Katanga secession. These forces, backed by substantial U.S. and Belgian military aid, recaptured all rebel-held towns, sealed off the borders, and established at least nominal control over most of the insurgent areas by the end of 1964. Dozens of European civilians and countless thousands of Congolese lost their lives in the fighting.

Tshombe's use of white troops, most of whom were South Africans or veterans of French colonial wars, did not ingratiate him with the political leaders of independent Africa. But with the support of some French-speaking African states, he broke out of his diplomatic isolation and secured the Congo's admission to the French-speaking Organisation Commune Africaine et Malgache (OCAM) in May 1965. Tshombe was unable to establish a nationwide political base, however, and in October 1965 he was removed from office by President Kasa-Vubu, who attempted to replace him with Katanga politician Evariste Kimba. On November 25, in an apparent effort to resolve the ensuing deadlock, Gen. Joseph Mobutu unseated Kasa-Vubu and proclaimed himself president, with fellow officer Léonard Mulamba, as premier, heading a civilian cabinet.

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## 7. Contemporary Zaire

In 1966 the centralizing, personalistic character of the new regime began to emerge. The popular Mulamba was dismissed and the post of premier abolished. As chief of state, Gen. Joseph Mobutu (later, Marshal Mobutu Sese Seko) now headed the ministerial council.

**Political Centralization.** Mobutu reversed the process of territorial fragmentation that had begun in 1960. From 21 provinces in 1965, the number was cut first to 12, then to eight, representing a nearly complete restoration of the colonial divisions. The provinces, once quasi-federal political units with their own governments, became "regions" reduced to administrative subdivisions of the unitary state. Not until 1982, when Mobutu accepted suggestions from external aid donors that he carry out political "liberalization," were the regions given legislative assemblies and a degree of political-administrative autonomy.

In 1967, Mobutu established the Mouvement Populaire de la Révolution (MPR, Popular Revolu-





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Matadi, Zaire's major seaport, is near the mouth of the Zaire River. The bridge was completed in 1983.

lutionary Movement) and made clear that no other parties would be permitted. The MPR was "the nation politically organized," and all Zairians were members by birth. The high point of centralization came with the 1974 constitution, under which the MPR was made the "sole institution" of society, with all other public bodies mere branches of the party.

All electoral choice took place within the MPR, but the range of choice varied. In the early years, single-party lists were put to the electorate, which had no choice but to vote yes or no. Afterward, multiple candidates were allowed so long as all stood under the MPR label.

The MPR initially espoused a doctrine of nationalism, borrowed from Lumumba's party and others of 1960. By 1971 it was promoting "authenticity," meaning that Zaire should reject foreign cultural influences, such as Christian names. By 1974 the official ideology had metamorphosed into "Mobutuism," and spokesmen for the regime were referring to the president as a "Messiah."

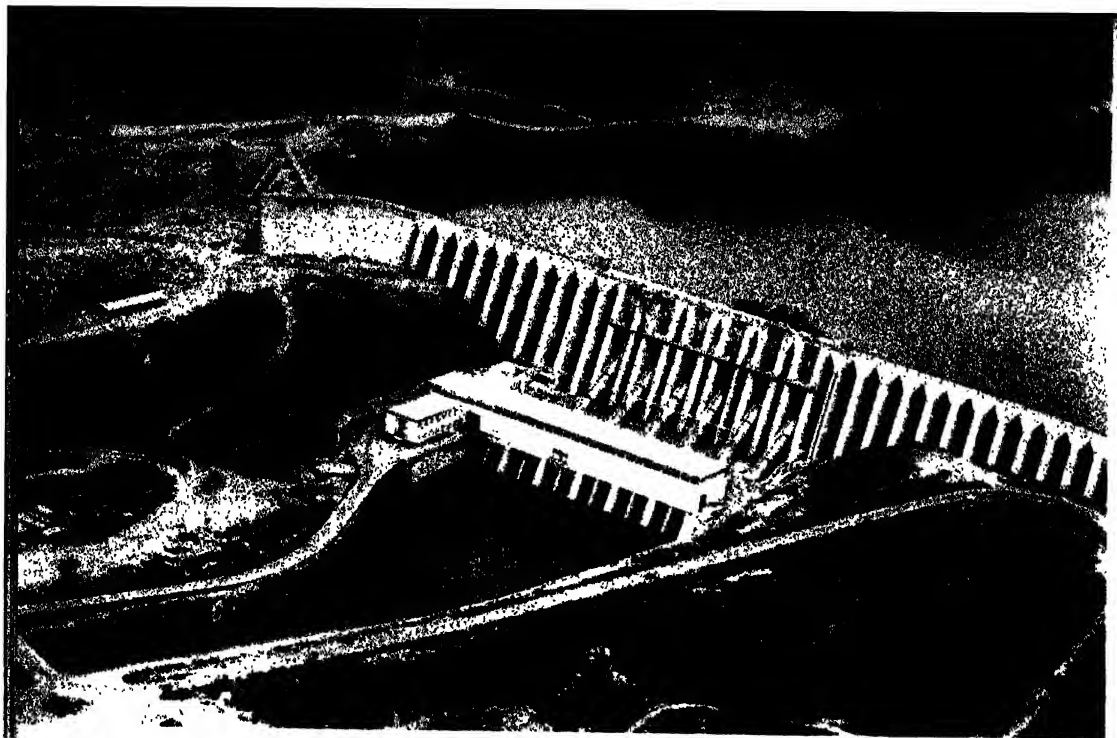
Mobutu's style of cabinet government required frequent reshuffles that opened up some new posts and reminded those ministers who were kept on that they could be dismissed next time. In a typical cabinet, all regions of the country were represented, but Mobutu's home region of Equateur was somewhat overrepresented. Often, one or more political exiles were "recuperated" and given a ministerial post.

Coercion was a major tool of governance. In 1986, the U.S. State Department reported that arbitrary arrest and prolonged detention without charges remained common in Zaire, affecting most people who came in contact with the criminal justice system.

**Economic Regression.** Nationalism implied Zairian control of the economy. By 1967 this objective had led to a clash with Belgium over control of Zaire's major industrial concern, the Union Minière du Haut Katanga (UMHK), which mined copper and cobalt. Eventually, a compromise was reached under which a state-owned mining company, the Générale des Carrières et des Mines (Gécamines) was created. The settlement proved lucrative to UMHK and brought unanticipated costs to Zaire.

In 1973 the government seized some 2,000 economic enterprises owned by foreigners (but not Americans), including plantations and construction and transportation firms, and turned them over to Zairians. The beneficiaries were mainly members of the political elite, with Mobutu himself profiting the most. This "Zairianization" had disastrous consequences, the scope of which became clear within a few months: shortages of goods, tax evasion, even abandonment of businesses. Instead of turning back, Mobutu plunged forward into the "radicalization of the revolution," apparently inspired by the models of China and North Korea. "Radicalization" included the nationalization of trade and the mobilization of agricultural brigades to relieve food shortages. In its application, however, the new measure was transformed from an attack on the Zairianized businesses to an assault on the primarily Belgian-owned industrial sector. The effect was to extend "Zairianization" to virtually all spheres of the economy.

**The Debt Crisis.** After 1975, Zaire's mounting foreign debt had a major impact on both domestic and foreign policy. By the 1980's the country owed \$5 billion. While this amount was only the eighth-largest in Africa, debt service ab-



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The Inga Dam and power project on the lower Zaire is one of Africa's most ambitious development schemes.

sorbed 43% of Zaire's annual budget for 1987, the highest ratio on the continent.

Some causes of the huge debt—for example, a rise in the price of petroleum imports and a fall in the price of copper exports—were beyond Zaire's control. Others were not, notably "Zairianization," "radicalization," the squandering of funds on prestige projects, and the diversion of funds into private overseas bank accounts.

In 1976 the first of a series of economic stabilization programs was adopted, under the guidance of the International Monetary Fund (IMF) and other external forces. Each successive "Mobutu Plan" was supposed to reduce corruption, rationalize and control expenditures, increase tax revenues, limit imports, boost production, improve the transportation infrastructure, eliminate arrears on interest payments, make principal payments on time, and improve financial management and economic planning. Zaire's public and publicly insured debt was rescheduled by the "Paris Club" (diplomats of the leading creditor nations) more than half a dozen times. Private creditors rescheduled their part of the debt in 1980, and numerous meetings of World Bank and Western aid consortia were held to generate further official assistance.

When the first two standby agreements with the IMF yielded meager results, the IMF and the World Bank decided to send in their own teams of experts to run key posts in the Bank of Zaire, the customs office, and the ministries of finance and planning. The head of the Bank of Zaire team, Erwin Blumenthal of West Germany, cut off credit and exchange facilities to firms belonging to members of the political elite and imposed strict foreign-exchange quotas. However, Mobutu and his associates were able to evade many of the restrictions and to wear down Blumenthal and the other experts. After Blumenthal's departure in 1979, the international teams were exceedingly careful to avoid what

one member called the "political hotspots."

In 1981, however, Zaire began to cooperate with the IMF, laying off large numbers of civil servants and teachers. In 1983 it agreed to devalue its currency by 78% and to liberalize the economy. In response, the IMF agreed to a fifth standby arrangement, and the Paris Club agreed to roll over more than \$1 billion of debt, with a maturity of 11 years, against the eight years normally approved for debtor nations. In 1985 and 1987, the Paris Club rescheduled Zaire's debt for 10 years and 15 years respectively, making it clear that the greater leniency being shown to Zaire was by way of a reward for following IMF guidelines.

"Liberalization" of the economy, urged by the IMF and the United States, took different forms in different sectors of the economy. Air Zaire, the inefficient state-owned airline, lost its monopoly and sold off many of its planes. The corrupt minerals marketing board, Sozacom, became a marketing subsidiary of Gécamines. Private firms were licensed to purchase gold and diamonds, in order to provide an alternative to smuggling. This measure apparently was only partially successful, many prospectors concluding that better prices could be obtained by circumventing the middleman.

Although Zaire was following IMF guidelines, compliance was slow to generate greater economic activity within the country, let alone improved living conditions. Even if Zaire's main products should recover their former demand, Zaire would need to put most of the proceeds into debt repayment instead of investing in transportation, education, and health care.

Mobutu, said to be one of the ten richest men in the world, had enriched himself at the expense of the people, whose living standards declined. Zaire had regressed from being a major exporter of agricultural products to an importer of 60% of its food.

**AIDS.** Like many sub-Saharan countries, Zaire faced disaster in the form of a widespread viral infection that often leads to Acquired Immune Deficiency Syndrome (AIDS). In Africa, where the potentially lethal virus is transmitted primarily through heterosexual intercourse, the educated urban leadership appeared to be stricken in disproportionate numbers, with grave implications for the region's future.

**Foreign Relations.** Zaire's foreign policy shifted several times after 1965. The economic nationalism of the late 1960's, directed at ex-colonial companies, brought Zaire into conflict with Belgium. During the same period, relations with the United States remained close. Regional initiatives focused on stabilizing relations with neighbors, including several that harbored Zairian exiles.

In the early 1970's, Zaire distanced itself from the United States. It took a leading role among sub-Saharan states in breaking relations with Israel over that country's occupation of Egyptian territory. Mobutu's visit to China and North Korea influenced the rhetoric of his "radicalization" policy.

During the decolonization of Angola, in 1975, the Zairian army intervened on the side of the FNLA and UNITA movements, also backed by the United States and South Africa and briefly by China. But the Zairian forces were routed by the MPLA and its Cuban supporters. Afterward Zaire generally cooperated closely with the United States and its supporters. In 1977 and 1978, Zaire was invaded by exiles based in Angola and had to be rescued by its allies, including the United States, Belgium, France, and Morocco. When Chad's military regime dissolved into a welter of warring factions, Zaire's troops provided support to Chadian President Hissène Habré against former President Goukouni Oueddei, who was backed by Libya.

In 1979, once Egypt and Israel had signed the Camp David agreement and Israel had withdrawn from the Sinai and thus from Africa, Mobutu renewed relations with the Jewish state. Israel began training and directing the Special Presidential Brigade, which guarded the president. Zaire's close relationship with Israel was a factor in Libyan aid to Zairian opposition groups, apparently including the perpetrators of bomb blasts in Kinshasa in 1984.

Zaire's frontiers remained insecure. Zambia's efforts to block smuggling into Zaire led to clashes between their armies. In 1984 and 1985 at Moba, in the Shaba region, Zairian forces battled insurgents of the People's Revolutionary Army, heirs to the rebellion of 1964–1966. The Mobutu government alleged that these attacks, which originated on the eastern side of Lake Tanganyika, were permitted if not actually encouraged by Tanzania and Burundi.

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**ZAIRE RIVER.** See CONGO RIVER.

**ZAMA**, za'ma, a town in ancient North Africa where, according to tradition, the Roman army of Scipio Africanus crushed the Carthaginian army of Hannibal in 202 B.C. This crucial battle marked the end of the power of Carthage. By the terms of the peace of 201 B.C., Carthage lost its fleet and thereafter could fight, even in Africa, only with Roman approval. Ancient Zama is generally identified with the present village of Jama, in Tunisia. A village 30 miles (48 km) to the east also claims to be the site.

**ZAMBEZI RIVER**, zam-bé'zē, in southern Africa, the longest African river draining into the Indian Ocean. The upper Zambezi flows generally southward, the middle Zambezi northeastward, and the lower Zambezi southeastward. The total length of the river is about 2,200 miles (3,520 km) from Zambia to Mozambique and the sea. With its tributaries the Zambezi drains an area of some 500,000 square miles (1.3 million sq km), mostly on the interior African plateau. The river is called the Zambeze in Portuguese.

The Zambezi begins in northwestern Zambia, in a bog near headwaters of the Congo River system. Leaving Zambia, it flows through Angola in a rockbed. It then reenters Zambia, broadening out before passing over Chavuma Falls and crossing the Barotse floodplain. From Ngonye Falls the Zambezi descends through 80 miles (130 km) of rapids to enter the plain of Sesheke. There it forms the boundary between Zambia and the Caprivi Strip extension of Namibia.

After defining the short Zambia-Botswana border the river marks the entire frontier between Zambia and Zimbabwe. First it enters a rocky reach that extends to Victoria Falls, or Mosi-oa-Tunya ("The Smoke That Thunders"). The upper Zambezi ends as it plunges 355 feet (108 meters) in a cloud of spray and a thundering roar into a narrow transverse chasm.

The first section of the middle Zambezi is the Gwembe Valley. For 175 miles (280 km) above Kariba Gorge the valley has been flooded by the reservoir of the Kariba hydroelectric dam, completed at the gorge in 1959. Downstream the river receives two important tributaries from Zambia, the Kafue and the Luangwa. Just after entering Mozambique the Zambezi flows into a second large artificial lake, formed by a hydroelectric dam completed in 1974 at Cabora Bassa Gorge.

From the dam the Zambezi descends from the plateau and flows across the Mozambique Plain, where it receives the Shire River running southward from Lake Nyasa (Lake Malawi). The Zambezi reaches the Indian Ocean through a wide delta that begins 90 miles (145 km) from the coast and covers 25,000 square miles (65,000 sq km). Each of the four main mouths of the river is obstructed by a sandbar at its entrance.

Shallow-draft river vessels can use the Zambezi from the mouth of its Chinde passage through the delta as far inland as Cabora Bassa Dam. Upstream the lakes are similarly navigable, as is the upper Zambezi from Ngonye Falls to Chavuma Falls and into Angola.

The Zambezi has no major port at its outlet and few large towns or cities along its course. The most important riverine urban centers are Tete in Mozambique and Maramba (formerly Livingstone) in Zambia, near Victoria Falls.

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ACE WILLIAMS, FROM BLACK STAR

The spectacular Victoria Falls, on the Zambezi River between Zambia and Rhodesia. The Scottish explorer and missionary David Livingstone named the falls in 1855 in honor of the British queen.

**ZAMBIA**, zamˈbē-ə, a landlocked country in Southern Africa. Formerly known as Northern Rhodesia, it is bordered by eight other states. Zambia is named for the Zambezi River, which has an important place in the national economy. The country is rich in minerals and has long depended on exports of copper.

Zambia gained independence under its new name in 1964. Because of its geographic position, it has played a strategic role in the efforts of black Africans to end white control of areas to the south.

### 1. The Land

Zambia lies to the north of the Zambezi, one of Africa's greatest rivers. The national territory is shaped rather like a butterfly because the Shaba (formerly Katanga) region of Zaire almost cuts Zambia in half, making two large "wings."

**Physical Features.** Zambia is part of the Southern African uplands. It is mostly a flat or undulating plateau, averaging 3,000 to 5,000 feet (915–1,525 meters) above sea level. To the south the Zambezi has cut a valley averaging only 2,000 feet (610 meters) in elevation. In the northeast the Mafingi Mountains rise to 7,100 feet (2,165 meters). Along the Zaire border elevation averages 4,200 feet (1,280 meters).

Geologically, the Zambian plateau consists of very ancient Precambrian rock. Parts of this rock are highly mineralized. But because the rock generally weathers into shallow, infertile soil, agriculture is limited. Around Lake Mweru are more recent Tertiary rocks, and in the Luangwa Valley, Cretaceous sediment—mostly sandstone—occurs. These areas contain the country's richest soils.

In the north are three lakes: Tanganyika and Mweru (both only partly in Zambian territory) and Bangweulu. They are used locally for transportation and are also important as a source of fish. The Luapula River flows southward from Lake Bangweulu, draining more than 3,800 square miles (9,800 sq km) of swampland; before swinging northward to form part of the border

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between Zambia and Zaire. It then enters Lake Mweru, from which its continuation—the Luvua, in Zaire—joins the Lualaba, or Upper Congo.

In the northeast the plateau is cut by the Luangwa River. Formed in the mountains near the Malawi and Tanzania borders, it flows southward through a fault trough. Unfortunately, most of its relatively fertile valley is infested with tsetse flies, which spread both human and animal sleeping sickness and thus limit the use of this area for agriculture. Part of the depression has been set aside as the Luangwa Valley Game Reserve.

Rising on the Zaire border is the Kafue River, which flows southward on the western plateau. Its valley, too, is dominated by the tsetse fly. The valley is the site of Kafue National Park, one of the world's largest game reserves, with some 8,000 square miles (20,700 sq km), on which

### INFORMATION HIGHLIGHTS

**Area:** 290,585 square miles (752,614 sq km).  
**Boundaries:** North, Zaire; northeast, Tanzania; east, Malawi; southeast, Mozambique; south, Zimbabwe, Botswana, and Namibia; west, Angola.  
**Elevations:** Highest—Mafingi Mountains (7,100 feet, or 2,164 meters); lowest—Zambezi River at the Mozambique border (1,200 feet, or 366 meters).  
**Population:** (1980 census) 5,679,808.  
**Capital and Largest City:** Lusaka.  
**Name of Nationals:** Zambians.  
**Major Languages:** English (official) and seven officially recognized African languages.  
**Major Religious Groups:** Christians and followers of traditional African religions.  
**Monetary Unit:** Kwacha (= 100 ngwee).  
 For Zambia's flag, see under FLAG, both illustration and text.

hunting is forbidden. Both the Luangwa and the Kafue rivers are tributaries of the Zambezi.

The mighty Zambezi rises in the northwest, near the juncture of the Zambia-Zaire-Angola boundaries, and flows southward in Angola and then in Zambia. It continues as Zambia's border successively with Namibia, Botswana, and Zimbabwe (formerly Southern Rhodesia). Just after it begins to mark the Zimbabwe frontier, it plunges 355 feet (108 meters) off the plateau, creating the spectacular Victoria Falls, or Mosi-oa-Tunya (the "Smoke That Thunders"). Here the river enters a trough and swings eastward in a great arc before reaching the Indian Ocean. Little of the Zambezi can be used for navigation. At Kariba a narrow gorge has been blocked with a dam that reaches a height of 420 feet (128 meters) and provides electricity for most of the country. The lake behind the dam is a source of fish.

**Climate.** Although Zambia is relatively close to the equator, its climate is moderated by its elevation. There are three seasons. From May to August the country is cool and dry. From September until November it is hot and dry. The wet season begins in December, and the rains last until April, mitigating the heat of the Southern Hemisphere summer.

Rainfall averages 23 inches (585 mm) in the south and rises to more than 50 inches (1,270 mm) in the north. The national average is 32 inches (815 mm), mostly as a result of thunderstorms.

Temperatures vary from 60° to 80°F (16°–27°C) in the cool season and from 80° to 90°F (27°–32°C) in the hot season. Only in the valleys is the heat excessive, especially in October.

## 2. The Economy

Although Zambia's prosperity is closely linked with the rich copper deposits along its northern border with Zaire, mining employs relatively few people. Most Zambians are traditional farmers, who grow food for their own subsistence and produce little surplus for market.

**Mining.** Africans for centuries have smelted Zambian copper to make pots and weapons. But



MARC & EVELYNE BERNHEIM, FROM WOODFIN CAMP

Copper bars being loaded at Kitwe for shipment. Zambia's prosperity is based on its rich copper deposits.

it was Cecil Rhodes and his followers late in the 19th century who began large-scale exploitation of the copper deposits that have become the mainstay of the Zambian economy. Fortunes were invested in the Copperbelt before the region began to yield its ore for overseas markets in the 1920's.

Copper and its by-products account for the greater part of the value of Zambian exports. The national income, therefore, is extremely vulnerable to fluctuations in world market prices. Most of the ore is smelted and refined in the Copperbelt before export.

Major lead, zinc, and cobalt deposits are mined and smelted at Kabwe (formerly Broken Hill), south of the Copperbelt. These minerals are exported as well. Smaller amounts of manganese, gold, and limestone are worked in other parts of the country.

**Manufacturing and Power.** Before independence Zambia had few large manufacturing enterprises outside the mining sector. Half of the nonmineral output consisted of foodstuffs, beer and other beverages, tobacco products, and construction materials. Most of the country's electric power came from the Kariba Dam on the Zambezi River, but the generators were located on the south bank, in Southern Rhodesia, where the white-minority government could cut off Zambia's power. The power problem was solved by the installation of hydroelectric generators on Zambia's side of the dam and by the construction of the Kafue power dam just south of Lusaka.

After 1964 industry quickly expanded and diversified. Major enterprises include textile mill-







JEN AND DES BARTLETT, FROM PHOTO RESEARCHERS

The paramount chief of Barotseland travels in the royal barge to the "flood capital" of Limulunga every year.

ing, motor-vehicle assembly, the manufacture of tires and batteries, oil refining (using imported crude), and the production of chemical fertilizers and mining explosives.

**Agriculture.** Some 7% of Zambia's area is cultivated, while 47% is classified as pasture or grazing land. Most Zambians are subsistence farmers who have to utilize the shallow, highly leached soils of the plateau. They grow maize (corn), beans, and cassava for local consumption. Commercial farms, generally along the railroad that runs from the Zambezi River to the Copperbelt, raise corn and tobacco for export. Irrigation projects along some of the rivers are of increasing importance because they extend the growing season into the dry period.

The tsetse fly prevents livestock raising in more than half the country. Among the people of Zambia, only the Lozi in Barotseland are noted for their herds.

**Transportation.** Under the administration of the British South Africa Company (1889-1924) and during the subsequent colonial period, a railway system was built to tie Northern and Southern Rhodesia together. At the time of independence, Zambia was largely dependent upon Southern Rhodesian rails. The line carried coal to the Copperbelt from Wankie (now Hwange) in Southern Rhodesia, as well as petroleum products, and took out almost 50% of the copper.

When political relations between Zambia and Southern Rhodesia reached a low point, landlocked Zambia began looking for alternative outlets to the sea. It built an oil pipeline, railroad, and highway to Dar es Salaam, Tanzania, to give Zambia a sure "all black" outlet to the Indian Ocean.

After 1976 this line was not of much use owing to problems on the railroad and massive delays at Dar harbor. A rail route through Angola to the Atlantic Ocean was closed by rebel guerrilla activity in that country. A third railroad cuts through Zaire but is slow and unreliable as well as expensive because it involves transshipment of cargo by river and then by rail again to seaports on the Atlantic. The most convenient route is still the one through former Southern Rhodesia, now Zimbabwe under black-majority rule. But Zimbabwe is also landlocked and depends on rail lines that reach the sea through

Mozambique or South Africa. Mozambique has suffered from chronic political instability, while South African racial policies make Zambia reluctant to use that country's ports, although it has done so.

### 3. The People

Most Zambians are of Bantu origin, the descendants of earlier migrants. As the Bantus driving southward moved into the area from early in the 1st millennium A.D. to about 1200, they pushed before them the Pygmies and Bushmen whom they found there. Nilotic groups from East Africa arrived early in the 2d millennium. Later, other African groups moved into the area from the south. Today, Zambia has more than 70 ethnic groups classified into eight major societies, speaking some 30 different dialects. English is the official language. Seven other languages are recognized for administrative and educational purposes: Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja, and Tonga. Many groups are spread across the borders of one or more of Zambia's eight neighbors.

**Major Groups.** Among the major ethnic groups are the Barotse in the southwest, ruled over by the Lozi people. For several hundred years they have occupied an area on the plains of the Zambezi northwest of Victoria Falls. The river is still their main artery of transportation. The Barotse are fine fishermen. They also own cattle (the area is free of the tsetse fly), plant crops in the dry season, and mine some potash and salt. Thus, Barotseland has an almost self-sufficient economy.

Each year the river floods, and those living at the regular Barotse capital of Mongu move to the "flood capital" of Limulunga. The paramount chief leads the way in a state barge with his drummers setting the pace, and the rest follow in canoes piled high with household goods.

Barotseland was treated as a special administrative entity before Zambia's independence. It then became a Zambian province.

The Bemba people, who live in the north along the Zaire border, are also a major group. Their language is the lingua franca in the Copperbelt because they constitute the bulk of its labor force. They have a highly organized society with centralized rule.

Because of the tsetse fly, the Bemba do not

raise cattle but engage in farming. Because the soil is poor as well, they practice a slash-and-burn agriculture in which they first cut, pile, and then burn the brush. The resulting ash enriches the soil, permitting crops—mostly maize—to grow. After a few years the soil is depleted, and the Bemba move on and repeat the process. It requires about 300 acres (122 hectares) to support a subsistence farm household in this manner. Consequently, the average population density is low—less than 4 persons per square mile (1.5 per sq km).

The Bemba fish in the swamps south of Lake Bangweulu. They grow cassava on the high, drier ground. They sell the fish in the Copperbelt or else trade it for maize with other Bemba people.

Members of the Chewa group, who live along the eastern border, engage primarily in subsistence agriculture. Parts of their area are not bothered by the tsetse fly, and some Chewa keep cattle.

Zambia has small but economically important European and Asian minorities. These groups reside mostly in the cities.

**Population Distribution.** Zambia as a whole is sparsely populated. The land is capable of supporting only a limited population over most of its area. The country nevertheless has a high birth-rate.

Cities have tended to develop only in the limited areas of rich mineral and agricultural resources. Over 35% of the people live in the Copperbelt, where most of the larger urban centers are found. These include Kitwe, Ndola, Chingola, Mufulira, and Luanshya. To the south is Lusaka, the largest city in the country and the national capital. More than 40% of the population is urban.

**Education and Religion.** Before independence, primary school cost \$30 per pupil annually and secondary school \$50—sums beyond the means of most Africans. With independence the nation declared free education for all, and school enrollment greatly increased thereafter. However, illiteracy remains a major problem. A modern

university was built at Lusaka. The government allots a sizable portion of its budget to education in an attempt to develop Zambia's most important resource—people.

About half of the people are Christians. Most other Zambians adhere to their traditional religions, whose practices are observed by many Christians as well.

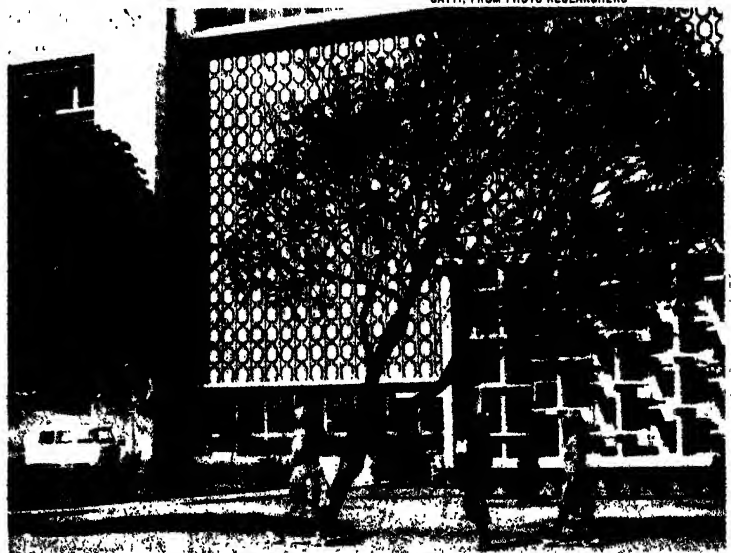
#### 4. History and Government

Human beings have been in the region that is now Zambia for perhaps 200,000 years. Remains of their early works have been found at Kalomo, Kalambo Falls, and south of Lusaka. More recently, the region served as a passage for Bantus migrating southward. Avoiding the hot, insect-infested Zambezi Valley and the desert to the west, they moved to the vicinity of Victoria Falls, where they could cross the river without descending from the plateau.

**European Exploration and Colonization.** The first Europeans in the area were the Portuguese, who explored a portion of the country in 1514. The Scottish missionary David Livingstone traveled through Barotseland in the 1850's, discovering Victoria Falls in 1855. By the time of his death in 1873, he had explored the entire Zambezi Basin and established missions in the hope of stopping the slave trade carried on by Arabs from the northeast. He helped to inspire British colonization of the area.

In 1889, Cecil Rhodes of the Cape Colony received a royal charter for the British South Africa Company to permit trade and establish a government in the future Northern Rhodesia. Rhodes persuaded Lewanika, paramount chief of Barotseland, to place his kingdom under British protection. Police and troops were stationed throughout the territory.

By 1900 company control had been formally established in the northwest and the northeast. In that year Lewanika signed over trading and mineral rights in his area. The northwest and northeast territories were joined with the protectorate of Barotseland in 1911 to form Northern Rhodesia. The British South Africa Company



A handsome university building in Lusaka. The Zambian government allots a considerable portion of its annual budget to education.

retained control of Northern Rhodesia until 1924, when the crown assumed administrative responsibility. The first capital, Livingstone (now Maramba), near Victoria Falls, was replaced in 1935 by Lusaka. Between 1927 and 1939, four large copper mines were opened, making Northern Rhodesia a major supplier of copper to world markets.

**The Nationalist Movement.** The need to amalgamate the two Rhodesias was a recurring theme among resident whites from 1915 on, and was intensified in World War II. In September 1953, despite years of vocal African opposition to the plan, Britain proclaimed the Federation of Rhodesia and Nyasaland. Because Africans felt that the federation was only an excuse to prolong white rule, riots and strikes occurred over the years in each of the territories, followed by the declaration of a state of emergency.

African opposition to white rule had given rise to the African National Congress (ANC), a supraethnic party that unified the people living between Lake Tanganyika and the Zambezi River. Harry Nkumbula, ANC president, led the fight against the federation. A more militant group under Kenneth Kaunda broke away as the United National Independence Party (UNIP) and won wide support. Political power in Northern Rhodesia passed for the first time from Europeans to Africans in the 1962 elections, won by an ANC-UNIP coalition. In 1963, ten years after its formation, Britain dissolved the federation. In January 1964 a new election was won by the UNIP. In preparation for national independence a presidential election was held in August. Prime Minister Kaunda ran unopposed. Finally, on Oct. 24, 1964, Northern Rhodesia was proclaimed the independent Republic of Zambia, with Kaunda as its president.

**The Republic of Zambia.** After independence Zambia was a multiparty state until 1973, when a new constitution abrogated the original 1964 charter. Following elections later that year, the country became a "one-party participatory democracy."

The constitution of 1973 provided for a strong presidency and a single legislative chamber, with the UNIP Central Committee formulating national policy to be executed by the cabinet. All candidates for the National Assembly had to be members of the UNIP and their candidacy approved by the Central Committee. The constitution further provided for a national election every five years, the president and members of the National Assembly being elected by popular mandate. The president was empowered to appoint ten additional members of the Assembly to enhance its geographical or ethnic representation. Subsequent elections renewed the presidency of Kenneth Kaunda, the only candidate.

Kaunda's greatest asset was his ability to appease Zambia's various ethnic, religious, and regional groups. His basic platform was "humanism," in which he condemned human exploitation and stressed cooperation among the people, but not at the expense of the individual. The press remained free to criticize virtually anything except Kaunda's exercise of the presidential authority.

While Kaunda's political policies earned him praise and popularity at home, his economic policies and events over which he had no control bankrupted the nation. After independence, the gross national product (GNP) per capita declined

drastically. The economy remained based on the copper industry, which traditionally accounted for half of the GNP, a third to a half of government revenue, and over nine tenths of foreign-exchange earnings. For the first ten years of independence, copper export earnings climbed; then they fell as the world market price declined. To try and overcome the price decline, a shortage of technicians in the Copperbelt, the long-term effect of oil price increases, and dislocations in transportation, Zambia in 1970 acquired a 51% interest in the two major mining companies. These were merged in 1982 as Zambia Consolidated Copper Mines.

To reduce dependence on copper, the government tried to restructure and diversify the economy. It began a program of state-run industries and periodically nationalized others, eventually operating hotels, transportation services, breweries, mills, and the agricultural wholesale trade. Most such enterprises incurred losses. Food production declined by 25% over ten years. To encourage increased agricultural output, Kaunda announced tax concessions and higher prices for producers, along with improved marketing policies. However, the country did not become self-sufficient in food and continued to spend scarce foreign exchange on food imports.

Foreign aid and loans were intended to promote the development of agriculture, transportation, and manufacturing. But because of government mismanagement and severe drought, Zambia was unable to comply with an austerity program developed by the International Monetary Fund (IMF). In December 1986, Kaunda tried to raise the price of maize by reducing subsidies that had benefited urban dwellers. This measure would have enabled him to pay farmers more and to lower the budget deficit. City dwellers rioted in protest. Four months later, the president sought to raise fuel prices to cut imports and save foreign exchange, but with the same result. In both instances, Kaunda was forced to back down. As a result, Zambia renounced its agreement with the IMF and abandoned its austerity program.

Meanwhile, at the United Nations Conference on the Critical Economic Situation in Africa (May 1986), 24 other African countries had accepted IMF recommendations for economic reforms. These included emphasis on the development of agriculture, transportation, and communications, and improved economic management with less state intervention and greater encouragement of the private sector. The Zambian government, however, was participating substantially in the economy through state-owned or state-controlled companies. For example, the Zambia Industrial and Mining Corporation employed a third of the country's wage earners and accounted for almost half of the gross national product. Only in agriculture, banking, and construction was the private sector of the economy dominant.

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The city hall in Zamboanga, a seaport and tourist center of Zamboanga del Sur Province.

Philippine Travel and Tourist Assn.



**ZAMBOANGA**, sām-bō-āng'gā, municipality, the Philippines, in Zamboanga del Sur Province, on Mindanao, at the southern tip of Zamboanga Peninsula, about 550 miles south of Manila. It is separated by Basilan Strait from Basilan Island, which was once included in the municipality. Zamboanga is the trade center of southwest Mindanao and the area's chief port for both inter-island and international shipping.

Established by the Spanish in 1635 as a stronghold for their campaign against the Moros, Zamboanga was the capital of Mindanao during the entire period of Spanish domination except from 1872 to 1875, when the capital was Cotabato. It was partially destroyed by fire during the revolution of 1897-1898 but was rebuilt and improved during the ensuing United States occupation. When Zamboanga Province was created in 1914, the city became its capital. During World War II, the Japanese fortified the area, which suffered some devastation before it was taken by United States forces in March 1945. It is one of the most colorful cities in the Philippines and attracts numerous tourists. Pop. (1960) 131,411.

**ZAMBOANGA DEL NORTE**, sām-bō-āng'gā dēl nōr'tā, and **ZAMBOANGA DEL SUR**, sām-bō-āng'gā dēl sōor, provinces, the Philippines, on western Mindanao, including all of Zamboanga Peninsula west of Misamis Occidental Province, together with the adjacent islands. The peninsula is divided longitudinally from northeast to southwest between the two provinces. Zamboanga del Norte occupies the northern and western segment, 2,285 square miles in area, with a long coastline on the Sulu Sea, indented by Dapitan, Sindañgan, and Sibuko bays; the capital is Diplog, in the extreme northeast. Zamboanga del Sur comprises the peninsula's southeastern portion on Sibuguey Bay, Moro Gulf, and Illana Bay, with a deep indentation at Dumanquilas Bay (Moro Gulf). Its area is 4,232 square miles, including the large islands of Basilan (q.v.), off the southern end of the peninsula, and Olutanga. The capital is Pagadian, at the eastern end of the peninsula, on Illana Bay; the municipality of Zamboanga (q.v.), at the southern tip of the peninsula, is also in Zamboanga del Sur.

Except for the fertile coastal plains, the provinces are mountainous, the highest point being ~~Mount~~ Dapiak (8,620 feet) in northeastern Zamboanga del Sur. The mountains provide an abundance of timber suitable for shipbuilding and furniture making; gutta-percha and almaciga, a

varnish resin, are exported. Gold is mined, and the coalfield at Malangas, in Zamboanga del Sur, is the largest in the Philippines. Coconuts and abaca are the chief crops. Rice, maize, sweet potatoes, bananas, and rubber are also grown, and carabao, hogs, cattle, and chickens are raised. Fishing is an important economic activity, especially at Zamboanga and Basilan. The people are predominantly Christian, but there are numerous Moros in the coastal and river regions.

**History.**—The Moros entered the area of the two provinces in the middle of the 15th century, and the Spanish arrived in 1565. Expeditions of Spaniards and Christian Filipinos fought the Moros throughout the 17th century. The area was made a Spanish military district and in 1860 became one of the six districts of Mindanao and Sulu. A rebellion broke out in 1897, and in 1898 revolutionary forces took possession. In 1903, under United States rule, the area became a district of Moro Province, and in 1914 it was reconstituted as Zamboanga Province, with the city of Zamboanga as its capital. It was divided into the present two provinces in the period following World War II. Pop. (1960) Zamboanga del Norte 280,391; Zamboanga del Sur 744,469.

**ZAMIA**, zā'mē-ə, a genus of gymnosperms in the family Cycadaceae, found in tropical and subtropical America. *Zamia floridana* and *Z. pumila*, growing in Florida, are the only cycads native to the United States. Other species of these cycads are native to the West Indies, Mexico, and Central and South America.

The stem is usually short, bulbous, and partly embedded in the earth. The leaves are pinnately compound, quite rigid, and grow in a spiral cluster at the top of the stem, giving the appearance of a small palm tree. Male and female cones occur on separate plants and are easily distinguished, the male cone being slender, the female cone stout.

The stem contains a starch that is edible if properly washed to remove a poisonous alkaloid. It can be made into a tapiocalike pudding. Florida Indians and natives of the West Indies formerly used it for food; but they are not common enough and do not grow fast enough to be considered food plants of importance any longer.

Plants of this genus make attractive ornamentals as indoor potted plants or for outdoor landscaping where the weather is not too cold. Propagated by seed, they can be transplanted and will survive out of soil for a week or longer without

much harm. After transplanting or severe drought, leaves frequently yellow and die. Six months to a year may pass before new leaves appear.

See also CYCALES.

ROBERT J. RODIN.

**ZAMOJSKI, Jan.** See ZAMOYSKI, JAN.

**ZAMORA**, sā-mō'ra, city, Mexico, in the State of Michoacán, on the Mexico City-Guadalajara highway, 95 miles west of Morelia, at an altitude of 1,782 feet. It was founded in 1540 by Viceroy Antonio de Mendoza as a fortified point against the nomad Chichimec Indians, and was named after Zamora, Spain, where most of its first settlers came from. In 1810 the Mexican revolutionary leader Miguel Hidalgo y Costilla accorded Zamora the title of city. It is now an agricultural and small commercial center, famous for its candies, liquors, and native crafts. It has also become well known for its Easter and Corpus Christi festivals. Pop. (1979) 90,000.

IRENE NICHOLSON.

**ZAMORA**, thā-mō'ra, province, Spain, in the northwestern part of the country, between the provinces of León (north), Valladolid (east), Salamanca (south), and Orense and Portugal (west). The area is 4,089 square miles. The province is divided into distinct regions by the Douro (Duero) River, which bisects it from east to west, and the Esla River, which flows south into the Douro. The western part is mountainous with heights up to 7,000 feet in the Sanabria region on the borders of Portugal and Galicia. Toward the east, the northern sector becomes a rolling plain and blends into the central Castilian plateau; this part is given over almost exclusively to the cultivation of grains. South of the Douro lies the region of Sayago, whose name has become the epitome of rusticity in Spanish literature; it is an extremely rugged terrain, useful for little more than bare subsistence farming and the herding of livestock. A railroad runs north and south through the province. Zamora was long disputed by the kingdoms of León and Castile before their union in the 11th century. Besides the city of Zamora (q.v.), which is the capital, important towns are Benavente and Toro. Pop. (1982 est.) 201,869.

GREGORY RABASSA.

**ZAMORA**, city, Spain, capital of Zamora Province, situated on the Douro (Duero) River, 40 miles north of Salamanca. It is a market center for the agricultural products of the surrounding countryside. One of the most historic cities in Spain, it was the site of a famous siege in 1072 when the three children of Ferdinand I of Castile and León disputed the city. Numerous ballads deal with this period. The walls constructed earlier as a defense against the Moors still stand in places, and there are many old churches and other buildings. The cathedral was begun in 1151 in Romanesque style; the Church of La Magdalena (c. 1165) is considered one of the best examples of Spanish Romanesque architecture. There is a fine 14th-century bridge of sixteen pointed arches spanning the river. Zamora sided with the *comuneros* against Emperor Charles V in 1520-1521 and was the scene of strife between liberals and conservatives in the 19th century. Pop. (1982 est.) 54,684.

GREGORY RABASSA.

**ZAMORA-CHINCHIPE**, sā-mō'ra chēn-chē'pā, province, Ecuador, in the southeast corner of the republic, bounded on the east and south by the partially undermarked Peruvian border, on the west by the provinces of Loja and Azuay, and on the north by the Province of Santiago-Morona, from which it is separated by a line south of Gualaquiza. Zamora-Chinchipe and Santiago-Morona were established in 1953 by division of the former Province of Santiago-Zamora. The provincial capital is Zamora, located 35 miles east-southeast of Loja on the Zamora River at the eastern foot of the Cordillera de Zamora, which rises to 9,500 feet. The province is a mountainous and forested area in the foothills of the Andes, drained into the Amazon Basin by the Zamora and Chinchipe rivers. It is inhabited principally by Jívaro Indians. Pop. (1982) 46,691.

**ZAMOŚĆ**, zā-mōshch, city, Poland, in the Province of Lublin, on the Wieprz River, 45 miles southeast of the city of Lublin. Laid out by Jan Zamoyski in 1579 and modeled on an Italian city, with 16th century fortifications, an arcaded market square, and many fine houses, it is the best-preserved city of Renaissance times in Poland. The town hall and collegiate church are noteworthy. Furniture manufacturing is now the principal industry, although the city also trades in agricultural products. Pop. (1982 est.) 49,100.

**ZAMOYSKI**, zā-moi'skē, Jan (surname sometimes ZAMOJSKI), Polish statesman: b. Skokowka, Poland, March 19, 1542; d. Zamość, June 3, 1605. He received his education at the universities of Paris, Strasbourg, and Padua. While at Padua, which had the most famous law school of the day, he wrote *De senatu Romano* (1563), his most important work, and was elected rector of the university. Upon his return to Poland in 1565, he was appointed royal archivist and through this position gained a thorough knowledge of the law and politics of his native land. Zamoyski put this knowledge to practical use when he played a decisive role in the election of three successive Polish monarchs—Henry of Valois (1573; Henry III of France), Stephen Báthory (1576), and Sigismund III (1587)—and in the services he rendered to them and his country. As chancellor and hetman (commander in chief) under Báthory, he helped to defeat Ivan IV the Terrible of Russia in a long fierce struggle for the Baltic coast, ending in 1582. Throughout his career he opposed Habsburg candidates for the Polish throne and put an end to the Austrian claim by defeating Archduke Maximilian in the Battle of Byczyna (1588). Although pressed by Emperor Rudolf II and Pope Clement VIII, Zamoyski refused to join the Holy League against the Turks. Instead, he provided for the defense of Poland's southeastern frontier by a policy of armed neutrality toward Turkey, building new fortresses and placing pro-Polish hospodars in Moldavia and Wallachia.

Zamoyski is remembered not only for his political and military achievements, but also for his interest in intellectual and religious affairs. He founded the town of Zamość on his estates in 1579, established a university there (1595), and was instrumental in concluding the Union of Brest (Brześć) in 1596, which brought the Polish Orthodox communicants into the Roman Catholic Church.

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**ZAMPIERI, Domenico.** See DOMENICHINO.

**ZAMYATIN, zä-myä'tin, Yevgeni Ivanovich,** Russian novelist: b. Lebedyan, Russia, 1884; d. Paris, France, March 2, 1937. By profession he was a naval engineer. His first two novels, *Yezdnoye* (1911; *A District Tale*) and *Na kulichkakh* (1914; *At the End of the World*), satirical pictures of provincial life, placed him among the leaders of Russian neorealism. During World War I he spent two years in England building ships, and wrote *Ostrovityane* (1917; *The Islanders*), an exposé of British life. After the Russian Revolution his craft and brilliant irony influenced a score of young Soviet writers.

Zamyatin wrote sharp expressionistic stories such as *Peshchera* (1922; Eng. tr., *The Cave*, 1923) and *Mamay* (1922; Eng. tr., 1933) and challenging dramas such as *Ogni sviatogo Dominika* (1923; *The Fires of St. Dominic*), the latter based on the Spanish Inquisition. These, together with his provocative literary essays, made him highly unpopular with the Soviet authorities. Despite persecutions he maintained his independence and never ceased criticizing the new order. Publication abroad of *My* (1922; Eng. tr., *We*, 1924), a satirical preview of a communist society of the 26th century, provoked a violent press campaign against him in Moscow. In 1931 he was compelled to emigrate to France, and his name became taboo in the USSR: even after Stalin's death he was not included among the "rehabilitated" writers. He remains, however, one of the important Russian authors of the 1920's. In the West he is known mainly as the author of *We*, which inspired Aldous Huxley's *Brave New World* (1932) and George Orwell's *Nineteen Eighty-Four* (1949).

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**ZANDONAI, dzän-dö-nä'ë, Riccardo,** Italian composer: b. Sacco, Trentino, Italy, May 28, 1883; d. Pesaro, June 5, 1944. His musical studies included work under Pietro Mascagni at the Liceo Rossini in Pesaro, from which he was graduated in 1902 and of which he was director from 1939 until his death. His first opera, *Il grillo del focolare*, based on Charles Dickens' *Cricket on the Hearth*, was produced successfully at the Teatro Politeama in Turin in 1908. Although he composed considerable nonoperatic music, his fame depends largely on two of his nine later operas: *Conchita*, based on Pierre Louÿs' *La femme et le pantin* (Milan 1911), the title role of which was sung by Tarquinia Tarquini, whom he married in 1917; and *Francesca da Rimini*, after the tragedy by Gabriele d'Annunzio (Turin 1914), which is still frequently staged in Italy. His mature musical style, reflecting awareness of both Verdi and Puccini, was allied to the realistic style known as *verismo*.

HERBERT WEINSTOCK.

**ZANE, zän, Ebenezer,** American pioneer: b. near Moorefield, W.Va., Oct. 7, 1747; d. Martin's Ferry, Ohio, Nov. 19, 1812. Sons of a Pennsylvania Quaker, he and his brothers Silas and Jonathan founded (1769) the settlement of Zanesburg, renamed (1806) Wheeling, now one of the major cities of West Virginia. Zanesburg became the Ohio River terminus of the road from Cumberland, Md., which was used by many settlers in Ohio. A Virginia militia colonel during

the American Revolution, Ebenezer helped repel British and Indian attacks on Fort Henry at Zanesburg. During one of these engagements (1782) his sister Betty became a heroine when she retrieved a keg of gunpowder under heavy Indian fire. In 1796, on condition that he blaze a road from Zanesburg to Maysville, Ky., before Jan. 1, 1797, Congress offered him three lots in the Ohio territory, stipulating, however, that he pay United States bounty warrants, provide roads and ferries, and survey the tracts at his own expense. He fulfilled all the conditions, and the important trail that he blazed became known as Zane's Trace. On one of the tracts that Congress granted him, Zanesville, Ohio, was platted in 1797, and Lancaster on another in 1800.

**ZANELLA, dzä-něl'lä, Giacomo,** Italian poet: b. Chiampo, Vicenza Province, Italy, Sept. 9, 1820; d. near Vicenza, May 17, 1888. He became professor of philosophy and Italian literature at Vicenza Seminary after being ordained a priest in 1843. In 1853 he was suspended from his post for sympathizing with the ideas of the Revolution of 1848. He then held teaching posts at Venice and at Padua, where he was made professor of Italian literature in 1866. From 1871 to 1872 he was rector of the university. A nervous breakdown followed his mother's death, and he retired to a villa near Vicenza in 1876.

Zanella's first collection of poetry, *Versi* (1868), earned him immediate acclaim, and he continues to be recognized as a representative mid-19th century poet. *La religione, La veglia, Milton e Galileo*, and *L'evoluzione* are among his worthiest and most genuine poems; *Sopra una conchiglia fossile* (Fossil Shell) is his most celebrated lyric; all reveal the thematic desire to bring the spiritual need for religious faith into harmony with the new doctrine of evolution. As a translator of Thomas Gray, Shelley, and Henry Wadsworth Longfellow, he was—like Alfred Tennyson—capable of expressing anew the rightness of social, moral, and religious preoccupation in a calm spirit of reconciliation. Other works include *Scritti vari* (1877), *Vita di A. Palladio* (1880), *Paralleli letterari* (1885), and *Poesie* (collected 1928).

EUGENIO VILICAÑA.

**ZANESVILLE, zānz'vīl,** city, Ohio, seat of Muskingum County, 52 miles east of Columbus, on the Muskingum River at the mouth of the Licking. Major products include ceramic tiles, transformers, sheet steel, batteries, radiators, cement, hydraulic and farm machinery, packaged meats and dairy products, glass, stoneware, and art pottery. A distinctive feature is the Y Bridge, the stem of which is an east-west span across the Muskingum to the mouth of the Licking, where it forks, one span going to the north and the other to the south side of the Licking. There is an airport. The city's name honors Ebenezer Zane (q.v.), owner of the military bounty land parcel on which the city had its beginning in 1797. From 1810 to 1812 it was the capital of Ohio. It was incorporated in 1814. The novelist Zane Grey and the architect Cass Gilbert were born here. A council-manager form of government was adopted in 1958. Population: 26,778.

JAMES H. PICKERING.

**ZANGWILL, zāng'gwīl, Israel,** English author: b. London, England, Feb. 14, 1864; d. Midhurst,

Sussex, Aug. 1, 1926. The son of a poor Russian immigrant, he was educated at the Jews' Free School and London University, and became the literary interpreter of Whitechapel, the London ghetto at the close of the 19th century. His books *Children of the Ghetto* (1892), *Ghetto Tragedies* (1893), *The King of Schnorrers* (1894), *Dreamers of the Ghetto* (1898), and *Ghetto Comedies* (1907) gained him the reputation of being Anglo-Jewry's greatest writer. Zangwill retold in English many tales known to generations of Yiddish-speaking Jews in eastern Europe and overheard by him in London's immigrant quarters. His marriage to a non-Jew in 1903 led him to write *The Melting Pot*, in which he defended intermarriage between persons of different faiths; the title of this play, produced in New York City in 1908, became a synonym for the Americanization of immigrants. The drama proclaimed that America was God's crucible, into which was to be hurled the entire heritage of the Old World past—its dreams and sacrifices, traditions and superstitions—and out of which a new product would emerge, the new man and the new culture that would be far better than the old. Other Zangwill plays were less successful. They range from a light comedy based on his earlier novel *Merely Mary Ann* (1893) and the pacifist drama *The War God* (1911), to his last play, *We Moderns* (1923).

Zangwill was the first English disciple of Theodor Herzl, father of Zionism. After Herzl's death in 1904, however, he broke away from the Zionists' concentration on the return of Jews to their historic homeland in Palestine, and in 1905 founded the Jewish Territorial Organization for the settlement of homeless and persecuted Jews in autonomous territories wherever available. He was president of this movement until its dissolution in 1925. His essays on Jewish themes were collected in *The Voice of Jerusalem* (1920). His provocative address to the American Jewish Congress, *Watchman, What of the Night?* (1923), aroused fierce controversy. He also translated Hebrew liturgical hymns into English and made English translations of the Hebrew poems of the medieval Sephardic lyricist Solomon ben Judah ibn-Gabirol.

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**ZANTE**, zān'tē (Gr. ZAKYNTHOS; Lat. ZACYNTHUS), island, Greece, one of the Ionian Islands, in the Ionian Sea, 12 miles northwest of the Peloponnese across Zante Strait, and 10 miles south of the island of Cephalonia. It is 21 miles long, and up to 10 miles wide, with a 58-mile coastline indented by Laganas, a deep bay, at its southern extremity. The area is 168 square miles. The capital is Zante, situated on the site of the ancient Zacynthus, which has a good harbor on the east coast.

The west of Zante is rugged and mountainous, rising to elevations of 2,480 feet. A fertile alluvial plain covers the eastern half of the island; rich in vineyards, olive groves, and orchards, it provides the principal agricultural exports: currants, olive oil, and citrus fruits. Other crops are negligible, and goats are the only livestock. Gypsum deposits, sulfur springs, and mineral pitch are found, and petroleum has been detected. There is a small industrial production of soap, face powder, olive-pit oil, earthenware,

and *mantolata* (candy). Ninety percent of the inhabitants live in the eastern half of the island, and almost 30 percent in the capital. Earthquakes have been recorded since 1554, with severely destructive shocks in 1893 and 1953.

According to legend, Zante was settled by Zacynthus, son of the Arcadian king Dardanus, and later belonged to Ulysses (Odysseus), king of Ithaca. It served Athens as a naval base in the Peloponnesian War (late 5th century B.C.) and was taken by Macedon under Philip V, who surrendered it to Rome in 191 B.C. The island was occupied by the Normans in the 11th century A.D. and became a Venetian possession in the 15th century. For its subsequent history, see IONIAN ISLANDS. Pop. (1981) 30,014.

**ZANTHOXYLUM**, zān-thōk'sā-ləm, a genus of erect or climbing shrubs or trees of the family Rutaceae, closely related to the orange genus *Citrus*, often with prickly branches. The leaves are pinnately compound, sometimes reduced to three or, rarely, to one leaflet. The flowers are small, frequently dioecious, in axillary or terminal cymes or panicles, and are from three to five parted. The fruits, which are quite ornamental in several species, split in two at maturity, exposing one or two shining black seeds. *Zanthoxylum* is a large genus (150 species), found in both the Eastern and Western hemispheres, especially in their warmer parts, but extending as far north as Minnesota, Massachusetts, and Ontario in North America.

The commonest and hardiest species of the northern United States is *Z. americanum*, a shrub or small tree with odd-pinnate leaves and twigs that are generally prickly; hence the common name, prickly ash. The cymose inflorescences are axillary and sessile. The greenish white flowers have no calyx. The capsulate fruits are black and ellipsoidal. It is sometimes called toothache tree because the Indians and early settlers used its hot and acrid bark and that of *Z. clavaeherculis* for aching teeth; extracts of these temperate North American species, applied externally to the gums, are powerful diaphoretics.

The West Indian species are called yellowwood; *Z. cariboeum* is a tree 20 to 50 feet high whose prickly young stems are made into walking sticks, while the wood is used for inlaying and for furniture; *Z. crillosum* is the satinwood of the West Indies which, when first cut, has the odor of true satinwood; *Z. fagara* is a small tree common in the same region and in tropical America generally, producing a hard, heavy, reddish brown wood known as colima, ironwood, or wild lime. Still another species is *Z. emarginatum*, a shrub with coriaceous foliage, exported under the name of rosewood but called licca tree or lignumvorne locally.

Some species are so aromatic and pungent that in the countries where they grow they are popularly called peppers, especially *Z. piperitum* (Japan or China pepper), which is regarded as an antidote for poison. *Z. rhetsa*, an Indian species, has small yellow flowers and smooth round berries which, when unripe, taste like the skin of a fresh orange. Its fruits, and the seeds and bark of *Z. alatum*, which grows near the base of the Himalayas, as well as those of *Z. budrunga*, also Indian, are given as aromatic tonics in fever, diarrhea, dysentery, and cholera; they are used as a condiment in India and as a fish poison, and the small branches are employed to make

toothbrushes. The seeds of *Z. budrunga* are as fragrant as lemon peel. The powdered bark of *Z. hiemale* is given in Brazil for earache.

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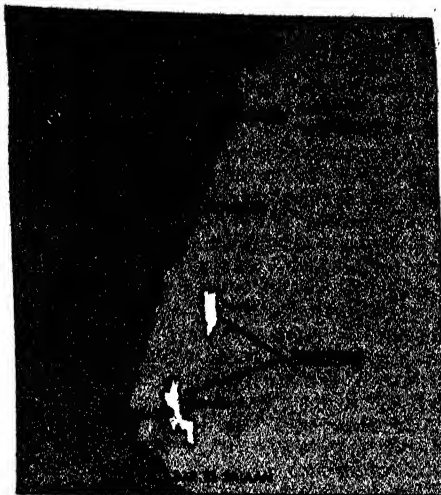
**ZANUCK**, zān'ək, Darryl F(rancis), American motion picture producer; b. Wahoo, Nebr., Sept. 5, 1902; d. Palm Springs, Calif., Dec. 22, 1979. After Army service (in spite of his extreme youth) in France during World War I, he began to write, edit, and finally produce for Warner Bros. Pictures, Inc., and was made chief executive in charge of production in 1931. In 1933, with Joseph M. Schenck, he organized Twentieth Century Pictures, which two years later merged with Fox as the Twentieth Century-Fox Film Corporation, with Zanuck as vice president in charge of production. Zanuck served in the Army again early in World War II, making training and documentary films, and in 1943 returned to his company. In 1956 he became an independent producer, releasing his films through Twentieth Century-Fox, and in 1962 he was elected president of the company. Recognized as one of Hollywood's most brilliant producers, he developed many new star performers and pioneered in the use of CinemaScope (q.v.). He received the Irving G. Thalberg Memorial Trophy in 1937, 1944, and 1950. Among his films are *Public Enemy* (1931); *The House of Rothschild* (1934); *Grapes of Wrath* (1940); *Anna and the King of Siam* (1946); *Gentleman's Agreement* (1947); *Pinky* (1949); *The Robe* (1953); *The Snows of Kilimanjaro* (1953); *The Man in the Gray Flannel Suit* (1956); and *The Longest Day* (1962).

**ZANZIBAR**, zān'zā-bār, is an island portion of the United Republic of Tanzania, a union of Tanganyika and Zanzibar. It merged with the African mainland country on April 27, 1964, only a few months after Zanzibar had itself become an independent nation. Zanzibar comprises the small islands of Zanzibar (640 square miles) and Pemba (380 square miles), both lying in the Indian Ocean off east Africa. Their combined area is half that of the state of Delaware.

**Physical Features.**—The island of Zanzibar is situated at 5°30' south latitude, 39°30' east longitude, approximately 22.5 miles across the Zanzibar Channel from the old Tanganyika port city of Bagamoyo. Nearly 53 miles long and 24 miles wide, it is the largest coral island on the African coast. It is gently rolling land, with Masingini Ridge (390 feet) as its highest point. Numerous bays, reefs, and islets are found along the western coast, while the eastern side is much more regular, with Chwaka Bay the only significant coastal indentation. A fringing reef guards the eastern shore for nearly 50 miles.

The smaller island of Pemba, approximately 35 miles northeast of Zanzibar and 40 miles from the Tanganyika shore, is 42 miles long and 14 miles wide. Also a coral island, it has an irregular coastline on the west and a straight one, accompanied by a fringing reef, on the east. Although its elevation does not exceed 300 feet, Pemba is much more dissected than Zanzibar.

Both islands experience a tropical monsoon climate with two marked rainfall and temperature periods. The two maximums of rainfall are the long rains in March, April, and May, and the short rains in November and December. The other months are dry, although they are rarely



Location map of Zanzibar, with principal towns.

without some precipitation. The annual rainfall approximates 60 inches on Zanzibar and 80 inches on Pemba. Although the seasonal temperature range for the year is small (only 6° F. at the town of Zanzibar), there is a marked difference in sensible temperatures brought on by a shift in monsoon winds. At the end of the long rains the southwestern monsoon winds bring fresh, relatively dry air into the islands from the South African landmass; temperatures average as low as 76° F. during July and August. The beginning of the short rains brings a shift of winds from the northeast. These antimonsoon winds, having blown out of Asia, sweep over the Indian Ocean and arrive below the equator both hot and moist. Average temperatures rise to between 82° and 85° F. by February and, joined with the high humidity, make a most enervating climate. This tropical, moist climate results in an abundance of indigenous and cultivated vegetation.

**The People.**—The combined population of Zanzibar and Pemba was about 475,000 according to the 1978 census—an increase of more than 100,000 over the 1967 census. The racial composition of the islands is heterogeneous. The major groups are Africans from the mainland, Arabs, and Asians. Although the Africans comprise about half the population, economic and political power rests mainly with the Arabs and Asians.

The Africans, mainly Bantus in origin, are divided into two distinct social groups: the Shirazis who are descendants of the original inhabitants of Zanzibar and Pemba with some claiming to be descended from Persian immigrants, and the mainland Africans, who are descendants of peoples from mainland East and Central Africa or more recent settlers from these areas. The Shirazis comprise approximately 61 percent of the total population of Zanzibar and Pemba; the mainland-African group, 21 percent. Economically, the Shirazis are predominantly fishermen or farmers on private or community lands, while the mainland Africans are town laborers or squatters on plantations. Both African groups are almost entirely Muslim.

With a population of about 69,000, Zanzibar city on Zanzibar Island is the only major settle-

ment on either island. The high population density of both islands is indicative of the fertile soils and intensive cultivation. These conditions are manifest on Pemba and in the central and western sections of Zanzibar, where there are heavy demands for labor on the large Arab- and Indian-owned clove and coconut plantations. High rural densities are also apparent on many small African farms growing fruit and vegetables as well as cloves.

**Economy.**—Zanzibar and Pemba account for most of the world's production of cloves. It is estimated that 80,000 acres with 4 million bearing trees are under cloves on the two islands. Unfortunately disease, as yet unconquered, is threatening disaster to the clove plantations on Zanzibar, so that Pemba accounts for about two thirds of the total annual production of 15,000 tons of dried buds. Nearly 76 percent of the value of the country's exports comes from cloves and clove products.

The coconut is the other cultivated agricultural product of note. Although older in the islands' economy than cloves, the production of coconuts is much less important. Products such as copra, coconut oil, and oil cake account for only 17 percent of the exports.

Cattle are numerous on both islands. Industry is limited, much of it being concerned with the processing of clove and coconut products. Shipping remains an important activity, however. Though by no means as important as it was 100 years ago, the old port of Zanzibar accommodates 3 million tons of shipping annually, not including 3,000 dhows.

**History.**—*Early Centuries.*—The monsoon winds have played an extensive role in the history of Zanzibar, as they have for much of the East African coast. Blowing rather constantly for six months from one direction and then shifting to blow for six months from the opposite direction, they permitted the merchant sailors of the Arabian Peninsula, Persian Gulf, and India to sail their dhows to East Africa to trade and, when the wind shifted, to return home. This ancient commerce has been carried on for well over 2,000 years. As a result, probably no other African area except Egypt can boast so long a history. The first written record of the area occurs in the Greek treatise *Periplus of the Erythraean Sea* (1st century A.D.) with an account of the island of "Menuthias," probably Pemba.

Paradoxically, little in the way of permanent settlement was carried out by the early traders. The earliest permanent inhabitants of the islands were Bantu migrants from the mainland, who settled there during the early part of the Christian era. At this time the Arabs referred to the East African area as "Zanjābar" (Land of the Blacks), from which the name Zanzibar was derived many centuries later.

Non-African settlement took place on the islands after the rise of Islam in the 7th century. War and unrest in Arabia and Persia stimulated migrations along the East African coast. In many cases settlements occurred on small offshore islands that afforded protection against the hostile Bantu. Because of their distance from the coast, Zanzibar and Pemba were slower to be settled; however, Persians arrived permanently on Zanzibar in 701, and Persians and Arabs on Pemba in 703.

Although trading centers and plantations were established, little of Zanzibar's history is re-

corded until the coming of the Portuguese in the 15th century. In 1503 Zanzibar came under Portuguese domination. Primarily concerned with establishing forts and revitalizing stations for their shipping in the East Indies trade, however, the Portuguese did little to develop tropical plantation agriculture, and aside from establishing the city of Zanzibar, their contribution to the development of either Zanzibar or Pemba was not great. The Arabs remained on the islands to continue their agriculture and expand their trade in slaves, ivory, and spices.

**Arab and British Rule.**—In 1698 the Omani Arabs drove the Portuguese from Pemba and in 1710 garrisoned their troops on Zanzibar. From that time until the late 19th century the Arabs held firm control, and Zanzibar attained its greatest historical importance. In 1832 Sa'id ibn-Sultan, the ruler of Oman, moved his capital from Muscat (Masqat) to Zanzibar, with the result that Zanzibar became the principal commercial and political center of East Africa. Its location made it ideal for outfitting slave-raiding caravans for their journey into the interior, and it became the great slave market for the returning raiders, importing 10,000 to 15,000 slaves annually during the early 1800's, most of them reexported to the Arab and Indian world. Zanzibar was also important as an outfitting post for many of the great East African explorers, such as John Hanning Speke, Sir Richard Francis Burton, and Sir Henry Morton Stanley.

In 1861 Zanzibar became independent of Oman. Pressure from the British gradually strangled the slave trade, and in 1873 the sultan ordered the great slave markets closed. However, Zanzibar's commercial position was not greatly weakened; so long as transportation facilities on the mainland were poor, the island retained a hold on the trading caravans and continued as a significant entrepôt center. Furthermore, both islands had developed into great spice producers as a result of the edict laid down by Sa'id ibn-Sultan providing that all plantation owners must plant three clove seedlings for every coconut palm or forfeit their plantations.

The sultan lost most of his claims to the African mainland in the power struggle between Britain and Germany in the latter part of the 19th century, and in 1890 the British proclaimed a protectorate over the dominions.

The protectorate remained in effect for 73 years. After 1955, constitutional reforms increased the representation of Arab, African, and Indian communities in the government. Political parties developed, but on a racial basis, and interracial hatred was generated between Arabs and Africans. In elections of 1961 and 1963, the Afro-Shirazi Party (Bantu and Bantu-Persian) won a slight advantage over the Zanzibar Nationalist Party (Arab). It was unable to form a government, however, and the Nationalists gained control of the legislature through coalition with the Zanzibar and Pemba People's Party (a break-away Shirazi group).

**Independence.**—Zanzibar attained internal self-government in June 1963 and full independence on Dec. 10, 1963, as a constitutional monarchy under Sultan Seyyid Jamshid bin Abdulla. On Jan. 12, 1964, the Arab-dominated government was overthrown in an armed uprising led by Afro-Shirazis and a leftist group known as the Ummas. Zanzibar was proclaimed a republic with Abeid Karume, Afro-Shirazi leader, as president.

Although Karume was regarded as pro-Western, the "People's Republic of Zanzibar" appeared to be dominated by communists, notably Abdul Rahman Mohammed, a key cabinet minister. On April 27, 1964, Zanzibar was merged into the United Republic of Tanganyika and Zanzibar (renamed Tanzania) in an apparent attempt to keep Zanzibar out of the communist camp. In this union, Karume became vice president under President Julius K. Nyerere of Tanganyika.

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**ZANZIBAR**, city, Zanzibar, is situated on the west coast of Zanzibar Island, 45 miles north of Dar es Salaam, Tanganyika. It is the commercial center of Zanzibar. The world's principal exporter of cloves, Zanzibar also ships citrus fruits, chilies, mangrove bark, and copra. Clove-oil distilling, soapmaking, coconut-oil pressing, and handicrafts are local industries.

Zanzibar was founded in the 1500's as a center for the East African trade. It gained prominence in 1832 when the Omani capital was transferred here. With the rise of the competing ports of Mombasa (in Kenya) and Dar es Salaam, its political and commercial importance declined. The inner town, Ngambo, is mainly the African quarter. Stone Town, facing Zanzibar Channel, is largely the Arab and Indian quarter. Pop. (1958) 57,923.

**ZAPATA**, sä-pä'tä, **Emiliano**, Mexican general and agrarian reformer: b. San Miguel Anenecuilco, Ayala, Morelos State, Mexico, Aug. 8, 1883; d. Chinameca, Ayala, April 10, 1919. An uneducated peasant, of Indian blood, he joined Francisco Madero in March 1911 in the movement

1914, forcing Carranza to flee. Zapata was soon compelled to withdraw to Tlaltizapán, south of Cuernavaca, in his native state of Morelos, where he continued fighting with his peasant army under the slogan of "land, liberty, and death to the *hacendados* [landowners]." Zapata had difficulty in controlling his undisciplined followers, who pillaged the villages between Mexico City and Cuernavaca, and he has been called variously the apostle of agrarian reform and the Attila of the south. He received strong support from his brother Eufemio, who died in a brawl in 1917. He himself was assassinated by Col. Jesus Guajardo, who pretended to be a peasant in Zapata's revolutionary army in order to kill him. See also MEXICO—27. *Modern Mexico*.

IRENE NICHOLSON.

**ZÁPOLYA**, zá'pö-lyö, or **SZAPOLYAI**, só'pö-lyoi, a leading family of the Hungarian nobility, probably of Slavic origin, which provided two kings of Hungary during the 16th century.

**STEPHEN ZÁPOLYA**: b. ?1448; d. 1499. An able lieutenant of King Matthias Corvinus of Hungary, he waged successful warfare against the Turks and contributed notably to the Hungarian conquest of Vienna in 1485.

**JOHN ZÁPOLYA**: b. Spišské Podhradie (Szepesváralja), Slovakia, 1487; d. Sebes (Szászsebes), Transylvania, July 22, 1540. The son of Stephen, he was voivode (governor) of Transylvania in 1511–1526. In 1514 he ruthlessly crushed the widespread revolt of oppressed serfs led by György Dózsa, and when the boy king Louis II came to the Hungarian throne in 1516, Zápolya served as regent. After Hungary turned down a Turkish demand for tribute, Turkish armies invaded the country. At the Battle of Mohács (Aug. 29, 1526) the greatly outnumbered Hungarians were routed, and Louis II was drowned while trying to escape; Zápolya kept his own forces aloof from the conflict. Fierce factionalism then reappeared within the Hungarian aristocracy over the question of a new king. A staunchly nationalist group, which wanted no ruler from a foreign country, above all no Habsburg from Austria, chose Zápolya as King John I. Slightly more than a month later, on Dec. 16, 1526, the Habsburg or court party awarded the crown to Archduke Ferdinand of Austria (later Emperor Ferdinand I).

Civil war immediately broke out between partisans of the rival claimants to the throne. In 1527 King John was forced to take refuge in Poland. As his chief counselor he picked a statesmanlike Pauline monk, Juraj Utješonović (George Martinuzzi, or Frater Georgius), who was bent on reuniting historic Hungary. To that end, in 1528 an unprecedented alliance was negotiated with the Turks, who carried out several campaigns on behalf of King John. In 1538 the childless John executed a diplomatic somersault and arranged the Peace of Nagyvárad (Grosswardein) with Ferdinand, whereby the latter would become sole king of Hungary upon John's death. The birth of a son to John robbed the settlement of all value.

**JOHN SIGISMUND ZÁPOLYA**: b. 1540; d. 1571. Son of John Zápolya, he was elected king of Hungary as John II by the supporters of his father on the latter's death. Ferdinand of Austria once more appealed to the sword. Recognizing the infant king as the legitimate sovereign, the Turks moved their armies into Hungary again and occu-



Emiliano Zapata

The Bettmann Archive

to liberate Mexico from the dictatorship of Porfirio Díaz. By November of the same year he was refusing to acknowledge Madero as president and had formulated his own Plan de Ayala for agrarian reform. When, after Madero's execution by counterrevolutionaries in 1913, Venustiano Carranza set up a new revolutionary government, Zapata repudiated his leadership also, joined forces with Francisco (Pancho) Villa, and entered Mexico City triumphantly with Villa in



pied (1541) the capital, Buda, and the rich farmlands to the east. John Sigismund had to be content with authority over Transylvania and the adjoining counties. He was succeeded, on his death, by Stephen Báthory.

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**ZAPOROZHE**, zá-pə-rozh'yə, oblast, USSR, in the Ukrainian SSR, between the Dnieper River and the Sea of Azov, with Dnepropetrovsk Oblast to the north and Kherson Oblast to the west. Formed in 1939, it has an area of about 10,000 square miles. The growing season in the oblast is 210 to 220 days, the annual precipitation averages 14 inches, and the fertile dark brown and black soils yield good harvests of winter wheat, sunflowers, melons, vegetables, potatoes, and corn for livestock. The Dnieper Dam and power station is a source of power for the growing industries of the oblast. Pop. (1983) 2,008,000.

W. A. DOUGLAS JACKSON.

**ZAPOROZHE**, city, USSR, capital of Zaporozhe Oblast in the Ukrainian SSR, 40 miles south of Dnepropetrovsk on the left bank of the Dnieper River before it bends to the southwest. A rapidly growing industrial city and an important river port, Zaporozhe lies on the main trunk line from Moscow to Sevastopol and has rail connections with Krivoi Rog and Donetsk (formerly Stalino) in the Donetsk Basin. Before the revolution it was noted for its large grain-handling facilities. Its modern industrial development dates from the early 1930's. A dam, built in 1927-1932, made complete navigation possible by submerging the rapids and raising the level of the river 121 feet. On the right bank is a large hydroelectric installation, Dneproges, with a capacity of 550,000 kilowatts (the greatest in the world for some years). The city is also noted for its metallurgical plant (Zaporozhstal) and electric furnaces (Dneprospeksstal), producing high quality steels. In addition, there are factories turning out aluminum, chemicals, and machinery. Although much damage was done to the city, its factories, and the hydroelectric plant during World War II, this was repaired by 1950.

Zaporozhe (known as Aleksandrovsk until 1921) or rather the islands in the river below the rapids, was a Cossack stronghold in the 16th century. The fortress (*sech*) served as a base for operations against the Turks, Crimean Tatars, and Poles; in the middle 1950's, however, the construction of a dam downstream at Kakhovka obliterated much of this historic setting. The city was not founded until 1770, and by 1910 the population was only 38,000. Pop. (1983) 835,000.

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**ZAPOTEC INDIANS**, zá'pə-tēk, an Indian people of the State of Oaxaca, in southern Mexico. Their language is related to Mixtec and more distantly to Otomí. Zapotec (*Zapoteca*) is the Aztec designation for this people; their own ancient name seems to have been *benezaa* or *vinizaa* (people of the clouds). This, as well as linguistic affinity, points to a common origin with their western neighbors, the Mixtec. They now identify themselves by different local variants of a term meaning "people who speak Zapotec."

Archaeologists have traced Zapotec prehistory

in central Oaxaca back to the 1st millennium B.C. The period of greatest splendor of the hilltop metropolis of Monte Albán, culminating in approximately 500 A.D., seems definitely creditable to this people. Later Zapotec pre-Columbian capitals were Zaachila and Mitla. See MEXICO—18. *Architecture* (Valley of Oaxaca); OAXACA (city)—*Archaeology*.

The territory now occupied by Zapotec communities includes a north-south band across the center of Oaxaca State and the southern section of the Isthmus of Tehuantepec to the east. Four main divisions are recognized: (1) the northern mountains (main towns: Ixtlán, Villa Alta, and Choapan); (2) the central valley of Oaxaca (Tlacolula, Centro, Etla, Ocotlán, Zimatlán, Ejutla); (3) the southern range (Miahuatlan); (4) the isthmus (Tehuantepec and Juchitán). In the early 1970's the Zapotec numbered more than 300,000 people.

Modern Zapotec culture is far from uniform. The differences are due to diversity of habitat, influence of neighboring Indian groups, and varying rates of colonial Spanish and modern Mexican acculturation. The nation includes closed traditionalist communities as well as townspeople, the bond between the distinct regional and cultural groupings being common language and group consciousness.

PEDRO ARMILLAS

**ZARA**. See ZADAR.

**ZARAGOZA**. See SARAGOSSA.

**ZÁRATE**, sä'rá-tä, city, Argentina, in Buenos Aires Province, on the Paraná de las Palmas River, 50 miles northwest of Buenos Aires. It is an important river port in a fertile agricultural and dairying region. Industries include meat-packing and paper milling. A railroad ferry connects it with the city of Ibicuy. Zárate was founded in 1801. It was called General José F. Uriburu from 1930 to the end of World War II. Pop. (1980) 65,504.

**ZARATHUSTRA**. See ZOROASTER.

**ZARATITE**, zá'rə-tit, a hydrous basic carbonate of nickel, often called emerald nickel,  $\text{Ni}_3(\text{CO}_3)(\text{OH})_4 \cdot 4\text{H}_2\text{O}$ . It is an emerald green incrustation, usually on chromite.

**ZARLINO**, dzär-lē'nō, *Gioseffo* (often called ZARLINUS CLODIENSIS), Italian musical theorist and composer: b. Chioggia, Italy, March 22, 1517; d. Venice, Feb. 14, 1590. A Franciscan monk, he studied music at the singing school of Adrian Willaert in Venice from 1541. In 1556 he was appointed maestro di cappella at St. Mark's in Venice, and he became a noted pedagogue. Few of his compositions survive. His signal importance in the history of musical theory derives from his *Istitutioni harmoniche*, published in four parts at Venice in 1558 and subsequently reissued; his *Dimostrationsi harmoniche*, a series of dialogues issued in 1571; and his *Sopplimenti musicali* (1588), a polemic reply to sharp attacks on his theories by his former pupil Vincenzo Galilei, father of the great astronomer, Galileo Galilei. Zarlino pioneered in urging a salient role for the immediate predecessor of the modern major scale, in the evolution of the manners of analyzing intervals and triads which became prevalent in the

18th and 19th centuries, and in urging the adoption of equal temperament, notably for tuning lutes.

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**ZARZUELA**, thär-thwä'lä, a musical stage piece, Spanish in origin and development, in which music and song alternate with dialogue. The name is derived from the palace of La Zarzuela, a royal country seat near Madrid, where the Spanish royal family attended festivals featuring this type of staged entertainment during the 17th century.

Modern zarzuelas are of two types: the *zarzuela grande* (grand zarzuela), usually serious and dramatic in character, in two or three acts; and the *zarzuelita* (little zarzuela), usually in one act, and comic in nature. The plots may be tragic, fantastic, melodramatic, or a mixture of these, often satirizing some literary work, opera, political situation, or other matter of the moment. The form is not definite, the singing is free and imaginative, and improvisation is employed. Extemporaneous comments and jokes may pass freely between the artists or even between the performers and the audience. Some features of the Viennese operetta and even of American jazz have been employed in recent zarzuelas.

Many of the best-known writers and composers of Spain have contributed to the thousands of zarzuelas that have been produced. Some pieces have been presented only once, while others, more stable in nature, have been presented numerous times, even at the Royal Opera House in Madrid. Some of the best-known zarzuelas were composed in the 19th century, notably *La Gran Vía* (1886) by Federico Chueca (1848–1908) and Joaquín Valverde (1846–1910), *El Duo de la Africana* (1893) by Fernández Caballero (1835–1906), and *La Verbena de la Paloma* (1897) by Tomás Bretón (1850–1923).

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**ZASULICH**, zo-sōo'lych, **Vera Ivanovna**, Russian revolutionist: b. Mikhailovka, Smolensk Province, Russia, 1851; d. 1919. She belonged to a family of the lesser nobility, but began to take part in revolutionary activities in early youth and at 18 was sentenced to two years' imprisonment. After her release she was again indicted and placed under surveillance until 1876. In 1878 the military governor of St. Petersburg ordered a political prisoner flogged because of a slight infraction of discipline. This created a great stir in revolutionary circles, and on February 5 Vera Zasulich shot and seriously wounded the general in his office, making no attempt to escape. A trial jury acquitted her, and the populace hailed the verdict with enthusiasm; but the authorities were alarmed and had the verdict set aside. Vera Zasulich escaped abroad and did not return to Russia until the amnesty of 1905. In 1900 she joined Vladimir Ilich Lenin and others in founding the émigré Marxist newspaper *Iskra*. When the Russian Social Democratic Party split in 1903, she associated herself with the Menshevik wing and opposed the October Revolution in 1917.

**ZAUBERFLÖTE**, Dīe. See MAGIC FLUTE, THE.

**ZAUDITU**, zou-dé'tōō (Eng. JUDITH), empress of Ethiopia: b. 1876; d. Addis Ababa, Ethiopia,

April 3, 1930. The daughter of Menelik II, she ascended the throne as "queen of kings" in 1917 after Menelik's grandson, Lij Yasu, who had succeeded him, was deposed. At the same time Ras Tafari Makonnen (later Haile Selassie) was made regent. Conflict ensued between Zauditu and Ras Tafari over his efforts to liberalize and modernize the country and to bring about its admission to the League of Nations, which he finally did in 1923. In 1928 he forced Zauditu to name him king. Thereafter, in spite of an unsuccessful attempt by her former third husband, Ras Gagsu, to restore her authority, she exerted little political influence, but retained her title until her death. See also ETHIOPIA—History.

**ZAWIERCIE**, zä-vyér'ché, city, Poland, in the Province of Katowice, on the Warta River, 25 miles southeast of Czeszochowa. It is situated adjacent to important coal- and iron-mining districts, and manufactures glass, textiles, chemicals, and metal products. Zawiercie was in Russian Poland from 1815 until the end of World War I, when it was incorporated in the newly reconstituted Polish state. During World War II it was occupied by the Germans, who gave it the name of Warthenau. It was returned to Poland after the war. Pop. (1981) 63,725.

**ZEÄ**, the name by which the Greek island of Kea in the Aegean Sea was sometimes known in the Middle Ages. See KEA.

**ZEALAND**, zē'länd (Dan. SJÆLLAND), island, Denmark, largest island of the kingdom, lying east-southeast of the Jutland Peninsula between the Kattegat and the Baltic Sea. It is separated from Sweden by the Øresund and from the island of Fyn by the Great Belt. Zealand is over 80 miles long and up to 72 miles wide, with a very irregular coastline and a total area of 2,709 square miles. It has no mountains, but the surface is variegated, with fertile fields and small hills intersected by canals. Large crops of grain are produced, and there are excellent pastures and rich fisheries. Copenhagen, the national capital, is on the east coast. The historic cities of Helsingør (Elsinore) and Roskilde are also on Zealand. Administratively the island is divided into five counties: Copenhagen (including Roskilde County District), Frederiksborg, Hallsbæk, Sorø, and Præstø. Pop. (1976 est.) 1,987,549. See also DENMARK.

**ZEALAND**, a province in the Netherlands. See ZEELAND.

**ZEALOTS**, zēl'ots (Lat. *zelotes* from Gr. *zelotai*), in ancient Jewish history, champions of traditional ways of Jewish life and opponents of Roman rule in Judaea. As adversaries of the Graeco-Romanizing activities of King Herod the Great (r. 37–4 B.C.), the Zealots inaugurated a program to restore the purity of Judaism and then developed a political party to oppose Roman overlordship. In their fanatical zeal they attracted many outlawed assassins and bandits, who terrorized Jews that sympathized with the Roman occupation force. These corrupt elements converted the organization into a crusade against the Romans and were chiefly responsible for the Romano-Jewish War of 66–70 A.D. The war resulted both in Jerusalem's destruction and the Zealots' own extermination, for the Romans eventually extirpated such

resisters as remained after the capital's surrender.  
P. R. COLEMAN-NORTON.

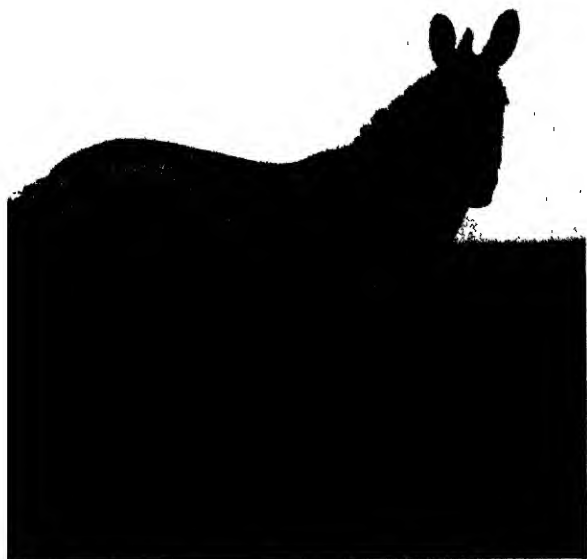
**ZEBRA**, zé'brā, a horselike animal, of the genus *Equus*, native to open grassy areas in Africa south of the Sahara. It is strikingly patterned with narrow alternate bands—black or blackish brown and white or yellowish—over much or all of the body. It is between the horse and the ass in size and form, and has a rather heavy head, short mane, stout body, and tufted tail. Grévy's zebra (*E. grevyi*) of the semidesert in northeastern Kenya, Ethiopia, and Somalia is the largest, nearly 60 inches high at the shoulder and banded almost completely down to the hoofs. The mountain zebra (*E. zebra*) of Cape Province and South West Africa is the smallest, about 48 inches tall; its numbers have been greatly reduced, in some areas to extinction. Most common and widely distributed over eastern Africa is Burchell's zebra (*E. burchelli*), of which many local races have been described.

Zebras live in herds, small or large, on open plains or hills, avoiding forests; the herds are often mixed with hartebeest, wildebeest, or other gregarious antelopes. They graze mostly in morning and evening, go to water at intervals, and rest usually by standing. When herds are excited, they gallop off speedily; near farms they may crash through fences and cause domestic horses or asses to stampede. Gestation lasts about 12 months, and the young run with the mother from birth. Zebras are prey for lions and leopards, yet may stand near the big cats when the latter are not hunting. African natives eat zebra flesh, but to other persons it has a strong flavor.

During the 19th century some zebras were caught in corrals and trained to harness; some were even used to draw stages in southern Africa; but they lacked the stamina of horses or mules. On the other hand, the zebra is sturdier, more compact, and speedier than either mule or ass, and is immune to blood diseases carried by flies and commonly fatal to imported horses or mules.

Burchell's zebra (*Equus burchelli*), photographed in Nairobi National Park, Kenya.

C. A. Spinnage from Annan Photo Features



Hybrids of zebra-horse and zebra-ass have been produced in the hope of obtaining domestic draft animals combining the desirable features of both parents, but these efforts have been unsuccessful because the hybrids have been infertile.

The quagga (q.v., *E. Quagga*) of southern Africa, which is now extinct, was a relative of the zebras.

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**ZEBRA GRASS** or **EULALIA**, a variety of perennial grass (*Miscanthus sinensis zebrinus*), from six to nine feet tall, native to eastern Asia and cultivated and found as an escape in the eastern United States. The leaf blades are banded or zoned with light-colored horizontal stripes. Two other varieties of this grass are cultivated as ornamentals: var. *variegatus*, with longitudinal stripes on the leaf blades, and var. *gracillimus*, with very narrow leaf blades. Discoloration (or variegation) in these grasses may occur as the result of a noninfectious disease, chlorosis, caused by a deficiency in certain chemical elements or other natural nonparasitic causes.

THEODOR JUST.

**ZEBRA PLANT**, a herb (*Calathea zebrina*), of the arrowroot family, Marantaceae. A native of Brazil, it is one of the commonest potted plants in warm greenhouses and is grown outdoors in Florida and other warm climates. The plants may be three feet high and produce as many as 20 leaves from a short base. The oblong-lanceolate unequal leaf blades may be two feet long and half as broad. They are a glistening deep green in color, with pale transverse bands on the upper side and purple bands on the lower. The violet and white flowers form a nearly globular spike. The plants are propagated by dividing their underground parts. Over 30 species of this tropical American and African genus are cultivated as ornamentals.

THEODOR JUST.

**ZEBRAWOOD**, zé'brā-wōōd, a name applied to several tropical trees of the pulse family, Leguminosae, but in the trade limited to *Brachystegia milbraedii* of central Africa. Wood of this species is pale brown and regularly or irregularly marked with dark brown stripes of varying widths, easily worked and lustrous when finished. The name is also applied to any of the five or six species of *Centrolobium* found from Panama to Ecuador and southern Brazil; wood of this genus is yellow or orange, usually variegated and sometimes marked by purplish streaks. *Marmaroxylon racemosum* of Dutch and French Guiana and Brazil is also called zebrawood; its wood is light yellow or orange brown and conspicuously marked by irregular purplish brown streaks. It is less easily worked and finished than the other woods.

THEODOR JUST.

**ZEBRINA**. See WANDERING JEW.

**ZEBU**. See CATTLE—2. *Breeds of Cattle* (Tropical Breeds).

**ZEBULUN**, zéb'yā-lān, or **ZABULON**, zāb'yā-lān, in the Old Testament, the tenth son of Jacob, the sixth by Leah (Genesis 30:19-20). He was the patronymic hero of one of the northern tribes

of Israel, mentioned for its heroism in the ancient Song of Deborah (Judges 5:18) and also in the Blessing of Jacob (Genesis 49:13): "Zebulun shall dwell at the shore of the sea; he shall become a haven for ships; and his border shall be at Sidon." The tribal territory lay in the fertile foothills north of the Plain of Jezreel and included the town of Nazareth (although Capernaum belonged to Naphtali; consult Matthew 4:12-16). The territory also lay along the prehistoric highway, the "Way of the Sea" (Isaiah 9:1), which doubtless yielded a certain prosperity, but also opened the land to the conqueror. Tiglath-pileser III carried away many captives to Assyria in 733 B.C. (II Kings 15:29), after which the tribe disappeared from history; but the name lingered on in the region, and after the exile was still remembered. Even in the New Testament it is used to identify the region.

FREDERICK C. GRANT.

**ZECHARIAH**, zēk-ə-rī'ə (sometimes **ZACHARIAH**; in Douay Bible, **ZACHARIAS**), a common Old Testament name meaning "Jehovah has remembered." Of some 29 persons bearing this name mentioned in the Bible, the following 4 are most important:

(1) in II Chronicles 24:20-22 (but not in the parallel account in II Kings 11, 12) Jehoiada, the reforming priest of Judah who overthrew Queen Athaliah (c. 837 B.C.), is said to have had a son Zechariah who continued his father's reforming policies and was murdered in the Temple court at the instigation of King Joash. This is the Zechariah referred to in Matthew 23:35, where he is erroneously called "the son of Barachiah" (see nos. 3 and 4). The connection made in Matthew between the shedding of his blood and that of Abel arises from the fact that the story of Abel is told in Genesis, the first book of the Old Testament, whereas that of Zechariah is told in Chronicles, which, in the Hebrew canon, is the last book; these two murders, the first and the last in the Old Testament, are taken to illustrate the whole history of Israel's treatment of her prophets and righteous men.

(2) Zechariah, the son of Jeroboam II, was the last king in Israel of the dynasty of Jehu. His assassination by Shallum (II Kings 15:8-12) at the end of a six months' reign (747-746 B.C.) marked the end of a long era of national prosperity and the beginning of the period of near anarchy that preceded the extinction of the kingdom in 721 B.C.

(3) Zechariah, the son of Jeberechiah, is mentioned as a contemporary prophet by Isaiah (8:2) and seems to have been a person of some importance. Nothing more is known of him. He seems to have been confused at times with the greater prophet Zechariah who was active some two centuries later (see no. 4).

(4). Zechariah, the 11th of the minor prophets as the books are at present arranged, was an important religious leader of the Persian age who, with his contemporary Haggai, was chiefly instrumental in arousing Zerubbabel the governor to begin rebuilding the Temple of Jehovah. In Ezra 5:1 he is called "the son of Iddo" but in Zechariah 1:1, 7 "the son of Berechiah, the son of Iddo." The addition of the words "the son of Berechiah" is probably the result of his being later identified with the 8th century prophet Zechariah, the son of Jeberechiah (see no. 3). Nothing is known of his personality or career be-

yond the brief reference in Ezra and what may be inferred from the first eight chapters of the book which bears his name.

From Nehemiah 12:4 we learn that Zechariah's father Iddo had been among the priests who returned from exile in Babylon under the leadership of Zerubbabel and Joshua. For many years (538-520 B.C.) the people were so busy trying to reestablish their own national life under unfavorable circumstances that they could give no attention to rebuilding the Temple; but at last, in the sixth month of the second year of Darius' reign (520 B.C.), Haggai succeeded in stirring up enthusiasm for the project when he attributed the drought and famine that plagued the country to God's anger at the people's lack of zeal for His house (Haggai 1:9-11). Later in the same month Zerubbabel and Joshua began work on the Temple (Haggai 1:14-15), and two months later Zechariah joined his voice to that of Haggai (Zechariah 1:1).

All the prophecies of Haggai are dated within a brief three-month period, but Zechariah's prophetic ministry continued for at least two years (Zechariah 7:1), and the range of his interests was far wider than that of his principal contemporary. Haggai was almost entirely preoccupied with the rebuilding of the Temple, but Zechariah explicitly touches on this matter only incidentally (1:16; 6:13, 15; 8:9), at least in the oracles that have been preserved. He was far more deeply concerned with the spiritual and moral condition of the nation (7:9-10; 8:16-17). One feels in him much of the spirit of "the former prophets," of whom he speaks with evident admiration (1:4; 7:7, 12). Both he and Haggai were involved in an unsuccessful plan of the Jews to take advantage of disturbed conditions in the Persian Empire in order to declare their independence and to crown Zerubbabel as king-messiah. This is reflected in Haggai's last oracle (2:20-23) and in a mysterious oracle of Zechariah (6:9-15), which has come down to us in a deliberately mutilated form. The failure of this venture seems to have marked the end of Haggai's career, but Zechariah was led to turn his eyes toward the more distant future and to place his trust in what God, rather than men, would do (chap. 8). The colorful visions of Zechariah recorded in chapters 1-6 represent an important stage in the transformation of the older type of prophecy into the later apocalyptic type. In this respect he stands midway between Ezekiel and Daniel 7 to 12.

See also **ZECHARIAH, BOOK OF**.

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**ZECHARIAH, Book of**, in the Old Testament. Like the other larger prophetic books, it is not a unified work from a single hand, but a collection of partly heterogeneous materials from different authors and periods. It falls into two main divisions: chapters 1-8, which may with confidence be connected with the prophet Zechariah, son of Iddo, who was active in the last quarter of the 6th century B.C. during the Persian age; and chapters 9-14, which are of very different character and probably belong to the Greek period (that is, the end of the 4th century B.C. or later). This latter part is commonly called *Second Zechariah* or *Deutero-Zechariah*; since chapters 12-14 seem to be of different origin from 9-11, they are

sometimes distinguished further as Third Zechariah or Trito-Zechariah. The authentic oracles of Zechariah in chapters 1-8 have hardly any elements in common with these later chapters.

The 6th century Zechariah speaks in a series of elaborate visions and is much concerned with the Temple and the Temple ritual. The personalities mentioned and the circumstances reflected are those of the Persian age, and the world in which he lives is a world at peace; the problems discussed are chiefly those concerning the internal life of the people of God. In the second part of the book the picture is a very different one. There are no visions at all (in the sense of those in chapters 1-8); no historical personalities are mentioned by name, and some that are referred to cryptically have sometimes been identified with figures in the Greek period; several of the oracles reflect a time of war and are extremely militant, not to say ferocious, in tone; the problems reflected are chiefly those which arise from oppressive foreign rule and the effort to adjust to it. Besides these considerations of content it should be noted that chapters 9 and 12 each has the separate title "The burden [or oracle] of the word of the Lord," which sets them off from the chapters that precede and is found elsewhere in the Bible only in Malachi 1:1. There can be little doubt that chapters 9-14 contain a series of anonymous oracles that originally had no connection with the prophecies of Zechariah and should be treated separately from them.

The first part of the book also falls into two parts: chapters 1-6, which consist of a series of visions, and chapters 7-8, in which the words of the prophet appear in more conventional form. Some attempts have been made to attribute this distinction to a difference in authorship, but it appears more likely that it is due to the altered circumstances of writing. The greater sobriety of expression may well reflect the prophet's disappointment at the failure of the attempt to gain the throne for Zerubbabel.

**Chapters 1 to 8.**—The book opens (1:1-6) with a brief oracle of quite general character, urging repentance and expressly connecting the work of Zechariah with that of "the former prophets." In mood this oracle is more closely connected with chapters 7-8 than with the visions that follow. It is dated in the 8th month of the second year of Darius, two months later than the first pronouncement of Haggai (Haggai 1:1). The major portion of the book consists of a series of eight nocturnal visions (1:7 to 6:8), which are dated on the 24th day of the 11th month of the same year; there is also the coronation oracle (6:9-15). In each of the visions the prophet has an angelic interpreter who explains to him the meaning of the strange things he sees.

In the first vision (1:7-17) Zechariah sees a group of horsemen who have returned to Jehovah after passing over the earth and report that all is quiet. The angel assures the prophet that even though nothing seems to be stirring upon the plane of history, yet God is at work and will restore His Temple and bring prosperity to His people. The second vision (1:18-21) pictures four horns cut off by four smiths, obviously representing the destruction of Israel's oppressors by supernatural forces, as in the later apocalypses. In the third vision of the series (2:1-5) a surveyor is seen at work measuring the future city of Jerusalem, which is to spread abroad without limit and without walls and is to be glorified and

protected by the presence of God within it. These first three visions constitute a unit in themselves, all three being designed to reassure a discouraged people that God's purpose would yet be fulfilled. This section of the book is appropriately brought to a close (2:6-13) by an oracle of a different character, attributed by some commentators to another hand, which calls on the exiles still in Babylon to return in faith to Palestine.

The next two visions have to do with Joshua and Zerubbabel, the spiritual and political leaders of the Jerusalem community. In one (chap. 3) Joshua the high priest is shown dressed in filthy clothing, probably representing the nation and its accumulated sins. By God's favor the people's guilt is taken away, and Joshua is raised to honor and power; the figure of Satan appears in this story, not as God's enemy but as a prosecuting attorney. The fifth vision (chap. 4) is complex, and the text exhibits some confusion, but the main point is the dignity given to Joshua and Zerubbabel.

Visions six and seven describe the moral purification of the community, first under the image of a written flying curse that extirpates evil in the land (5:1-4), and then in the picture of a woman, personifying wickedness, who is placed in a basket and transported to Babylon (5:5-11). The whole series of visions comes to a close with the reappearance (6:1-8) of the horsemen of the first vision, who report the eventual accomplishment of God's purpose and the "quieting" of his "spirit." In an appendix to the visions (6:9-15) the prophet reports that he was commanded to provide a crown for the king-messiah who was to build the Temple. Originally this must have been Zerubbabel, but after the failure of the plan to make him king the oracle was changed into its present enigmatic and confusing form.

Nearly two years after the night visions, and while the Temple was well on its way to completion, visitors from Bethel came to Jerusalem to ask whether they should continue to fast in commemoration of the destruction of the old Temple. This visit stimulated Zechariah to produce a series of oracles in chapters 7 and 8. In 8:18-23 he answers their question by declaring that the fasts are to be transformed into feasts because of the favor that God is now beginning to show His people. In the past He had sent them into exile as a punishment for their failure to obey Him, especially because they had not regulated their corporate life by principles of brotherhood and justice (7:4-14), but now it was His will that Jerusalem should be restored to its former glory. The future was very bright before them if they had learned the lesson of ethical obedience (8:1-17).

The authentic prophecies of Zechariah offer ample evidence that the spirit of the pre-Exilic prophets had not been entirely crushed by the experiences of the Babylonian Exile and the rise of a more formal type of priestly religion. Zechariah himself was a priest, deeply concerned with the rebuilding of the Temple and the resumption of its worship, but his final admonition to the people as he looked into the future was in the authentic tradition of the great prophets of old: "Speak ye every man the truth to his neighbor; execute the judgment of truth and peace in your gates; And let none of you imagine evil in your hearts against his neighbor; and love no false oath: for all these are things that I hate, saith the Lord."



**Second Zechariah (Deutero-Zechariah) and Third Zechariah (Trito-Zechariah).**—This part of the book presents the reader with material of an entirely different type. Critical opinion is unanimous in separating these oracles from the rest of the book, although there is still some difference of opinion as to whether all of them come from the Greek period; a few scholars still maintain that the earlier chapters contain material which somehow survived from the pre-Exilic age. At one time there was a strong tendency to relate some of these enigmatic oracles to events in the age of the Maccabees (from 167 B.C.), but it seems increasingly doubtful that anything could have been added to the canon of the prophets at so late a date. Most probably they reflect the rise of Greece under Alexander the Great (r. 336–323 B.C.) and the obscure years of Ptolemaic rule in Palestine (c. 312–198 B.C.). The “Egypt” and “Assyria” referred to in 10:10–11 would then be Ptolemaic Egypt and Seleucid Syria. Even apart from the question of date, no part of the Old Testament presents so many problems to the interpreter as these mysterious chapters. Strangely enough, no less than four verses in this brief section are connected by the New Testament with the last days of Jesus (9:9; 11:12; 12:10; 13:7). In view of the great diversity of content and style within the chapters, it is better to think of them as a collection of miscellaneous oracles from several sources than as the product of a single mind.

The first oracle (9:1–8) was probably inspired by the triumphant southward march of Alexander the Great after the Battle of Issus (333 B.C.). This was taken by the author of 9:9–12 as preliminary to the coming of the Messiah and the return of the exiles to the Promised Land. In 9:13–17, where the Greeks are explicitly mentioned (although some scholars think these words are a later addition), they appear as enemies, and the sons of Israel are promised victory over them. This hostile attitude toward Greek rule seems to point to a later period (probably that of the Ptolemies), and the two following chapters (10 and 11), with their picture of a nation exploited by its “shepherds” (foreign rulers), help to explain the change of feeling. Two brief separate oracles (10:1–2; 11:1–3), which originally had nothing to do with this general context, have been artificially inserted here simply because the word “shepherd” occurs in each of them. The identity of the good shepherd of 11:4–14, who is repudiated by his flock and in turn repudiates them, is utterly mysterious, and the whole action described there is perhaps better understood as a prophetic parable than as an account of historical events.

A new title separates chapters 12–14 from the preceding section, and this fact, together with the new style and subject matter, has led to their being treated as a unit under the title Trito-Zechariah, a usage which may be retained for convenience although even these three chapters do not seem to come from a single hand. Their most notable characteristic is a strong tendency toward the apocalyptic. In 12:1 to 13:6 and chapter 14 there are parallel accounts of the last great battle of world history, in which the nations of the earth, representing the united forces of evil, are to be destroyed by the supernatural action of God; this is one of the stock features of the usual apocalyptic scheme. Especially interesting is the prediction that the institution of prophecy, which had evidently fallen into disgrace by the

writer's time, is to be abolished (13:2–6). A brief section at the end of the chapter (13:7–9) is out of place and belongs with the shepherd oracles of chapter 11.

Deutero-Zechariah and Trito-Zechariah, difficult as they are to interpret, are exceedingly valuable as giving us at least brief, if enigmatic, glimpses into the mind of the Jews in a period that is otherwise almost completely unknown. Their ethical tone is not very high, and there is a savage antipathy to foreign peoples (9:15; 14:12) that is rarely equaled in the rest of the Old Testament. Nevertheless one notes, on the credit side, that in the future kingdom of God the Philistines are to be welcomed as proselytes (9:7), the messianic ruler is to be a king of peace (9:9–10), and the whole section breathes a firm confidence that God rules over history and His good purposes cannot be defeated.

See also ZECHARIAH.

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**ZEDEKIAH**, zēd-ə-kī'ə, the last king of Judah of the house of David: r. about 598–587 B.C. A younger son of Josiah, he was originally named Mattaniah. When Nebuchadnezzar (Nebuchadrezzar) captured Jerusalem in 598 B.C., the 18-year-old king Jehoiachin surrendered and was carried away to captivity in Babylon along with “all the princes, and all the mighty men of valor, ten thousand captives, and all the craftsmen and the smiths; none remained, except the poorest people of the land” (II Kings 24:14, Revised Standard Version). Mattaniah, Jehoiachin's uncle, was left in Jerusalem as regent and was given the name Zedekiah (righteousness of Jehovah) by the conqueror. Although Zedekiah took an oath of allegiance to Nebuchadnezzar, he was unable, in spite of the warnings of Jeremiah, to resist the dissatisfaction of his subjects and their growing desire for independence. He entered into negotiations with neighboring states, and when Egypt organized an expedition into Asia in the 9th year of his reign, he revolted along with some of the other cities. Nebuchadnezzar sent troops against Jerusalem; an attempt by Egyptian forces to relieve the city failed; and it fell after undergoing famine and other terrible hardships for a year and a half. Zedekiah escaped but was captured and taken to Nebuchadnezzar at Riblah. His sons were slain, and he was blinded and sent to Babylon to spend the rest of his days in prison. Nebuchadnezzar's captain of the guard was sent into Jerusalem to plunder and destroy the city, leaving only “some of the poorest of the land to be vinedressers and plowmen” (II Kings 25:7).

Besides II Kings 24, 25, Zedekiah's story is told in II Chronicles 36 and in scattered chapters of the Book of Jeremiah. Various passages in Ezekiel (notably chaps. 12, 17) also refer to him.

**ZEEBRUGGE**, ză'brüg-ə (Fr. ZEEBRUGES), town, Belgium, in West Flanders Province, on the North Sea, about 10 miles north of Bruges. It was artificially created in the early 19th century to give Bruges an outlet to the sea, and is linked to Bruges by a canal 230 feet wide and 7 miles long. A mole, 9,843 feet long, protects the harbor. During World War I the town became famous through the daring raid undertaken on April 23, 1918, by the British admiral Sir Roger John Brownlow Keyes, which succeeded in making the port unusable for the German submarine flotilla which had been stationed there. A museum commemorates this feat. The town has a population of less than 5,000.

JAN-ALBERT GORIS.

**ZEELAND**, zē'land, Du. zā'lānt (formerly known also as ZEALAND), province, the Netherlands, in the extreme southwest, on the North Sea, bordering Belgium. Its area of 651 square miles comprises the land about the estuary of the Scheldt (Schelde) River and the offshore islands of Walcheren, North Beveland, South Beveland, Schouwen-Duiveland, Tholen, and Sint Philipsland. Some of these are now peninsulas rather than islands, having been connected with the mainland by dikes, roadways, and railway—South Beveland, Tholen, and Sint Philipsland with the mainland, and Walcheren with South Beveland. The capital of the province is Middelburg, on Walcheren. A substantial part of Zeeland, formerly unproductive salt marshes and largely submerged land, has been reclaimed by an elaborate system of dikes, dams, and draining systems, which have made agriculture possible on a large scale. These great engineering projects suffered greatly during World War II, when the dikes were bombed by the Allies to wash out the Germans and prepare the way for commando landings. There were also severe floods in the 1950's. After the war and the floods, however, work was resumed with new vigor; the Delta Plan, initiated in 1958, provided for further closure of the estuary by a system of gigantic dams to protect the region from future floods and to provide still more land for agriculture.

Zeeland is predominantly agricultural, producing cereals, flax, vegetables, and fruits. Dairying and horse raising are important, as are fishing and oyster and mussel culture. Besides maintenance of the system of dams and dikes, industries include the production of coke and coal-tar chem-

icals, flax spinning, knitting, and shipbuilding. Although most of the population is scattered in small villages and isolated homesteads, there are two cities of considerable importance: Middelburg, and Vlissingen (Flushing), the chief port. Other towns include Terneuzen, Goes, Sluiskil, Sas van Gent, Veere, and Zierikzee. Picturesque villages with colorful costumes and old customs persist in many regions, attracting many tourists.

Zeeland, with other parts of the Netherlands, passed to the dukes of Burgundy in 1432, and when Mary of Burgundy married (1477) Maximilian of Austria (later emperor), it came under the rule of the Habsburgs and hence (1555) of Spain. In 1579 it participated in the Union of Utrecht (see UTRECHT, UNION OF), and during the Eighty Years' War which the Netherlands waged for independence from Spain, it performed great deeds of heroism. Pop. (1960) 283,914.

See also NETHERLANDS, KINGDOM OF THE.

**ZEEMAN**, zā'mān, Pieter, Dutch physicist: b. Zonnemaire, Zeeland, the Netherlands, May 25, 1865; d. Amsterdam, Oct. 9, 1943. After studying at the University of Leiden, he became lecturer in physics there (1897-1900). His discovery of the spectroscopic phenomenon known as the Zeeman effect in 1896 brought him many international honors, including the 1902 Nobel Prize in physics, which he shared with Hendrik Antoon Lorentz. In 1900 he became professor of physics at the University of Amsterdam and in 1908 was also made director of the Physical Institute which was founded there. He experimented extensively with the propagation of light in vibrating media and published works in the field of magneto-optics, including *Messungen über das kerrische magneto-optische Phänomen* (1893); *Experimentaluntersuchungen über Teile, die kleiner als Atome sind* (1900); *Magneto-optische Untersuchungen* (1914); and *Verhandelingen . . . over magneto-optische versuchijnselen* (1921). See also ZEEMAN EFFECT.

**ZEEMAN EFFECT.** When a source of light radiation is placed in a homogeneous magnetic field, a spectrum line from the source is usually split into a number of separate components. In special cases the lines are shifted but not split. This influence of a magnetic field on the behavior of spectrum lines is called the Zeeman effect after the Dutch physicist Pieter Zeeman (q.v.), who discovered the effect in 1896. The electron theory



A section of Zeeland's coast, wrung from the sea. Defenses afforded by sand dunes in rear are reinforced by stone flooring, wooden pilings, and breakwaters.

Netherlands Information Service

of Hendrik Antoon Lorentz predicted and explained completely the so-called normal Zeeman effect (see ELECTRON THEORY—*The Zeeman Effect*). In 1902 Zeeman and Lorentz jointly received the Nobel Prize in physics for their work on this phenomenon.

The Zeeman components are polarized parallel or perpendicularly to the magnetic lines of force ( $\pi$  or  $\sigma$  components, respectively) if the light is observed at right angles to the magnetic field (transverse Zeeman effect). If the observations are made parallel to the lines of force (usually through a hole in the magnet pole pieces), the  $\pi$  components are absent, and the  $\sigma$  components show left- or right-circular polarization (Fig. 1). See also POLARIZED LIGHT.

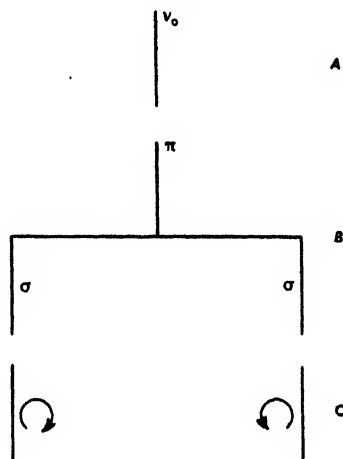


Fig. 1. The normal Zeeman effect. A, line without magnetic field; B, Zeeman pattern when viewed at right angles to direction of magnetic field; C, same when viewed parallel to field.

Absorption lines show the same type of Zeeman effect as do emission lines (inverse Zeeman effect) when the absorbing substance is placed in a magnetic field.

Clear Zeeman effects are seen most easily in atomic spectra, and less commonly in molecular spectra. Pronounced Zeeman effects are found in the absorption and fluorescence spectra of paramagnetic ions in crystals.

The simplest case, and the only one that could be explained by the prequantum classical theory, is the normal Zeeman effect. It shows three components—the middle one at the place of the original line  $\pi$ -polarized, and the outer two  $\sigma$ -polarized. Their separation from the central component of frequency  $\nu_0$  (see Fig. 1) is proportional to the magnetic field strength  $H$  (in gauss) and is in wave-number units ( $\text{cm}^{-1}$ )  $eH/4\pi mc^2$ , where  $e$  is the charge of the electron,  $m$  its mass, and  $c$  the velocity of light. This quantity  $\alpha = eH/4\pi mc^2 = 4.6687 \cdot 10^{-5} H \text{ cm}^{-1}$  is often called the Lorentz unit, and line separations observed in the Zeeman effect are usually expressed in these units.

The anomalous Zeeman effect, which is actually the most prevalent one, shows a more complicated pattern. There may be any number of components. In most cases the separations are rational fractions of the Lorentz unit. The distances between the components are proportional to  $H$  for isolated lines (linear Zeeman effect). Photographs showing the anomalous Zeeman effect of the yellow sodium doublet are given in Fig. 2.

low sodium doublet are given in Fig. 2.

When the field-free distance between two or more lines is not large compared with the Zeeman separation observed in the magnetic field, the Zeeman separations are no longer proportional to



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Fig. 2. Anomalous Zeeman effect of yellow sodium lines at 5889.95 Å (right) and 5895.92 Å (left). Bottom: Parallel ( $\pi$ ) components of emission lines. Middle: Perpendicular ( $\sigma$ ) components of emission lines. Top: The unpolarized effect in absorption (inverse effect). Magnetic field was slightly lower for top photograph.

$H$ . For small deviations from linearity there is a part proportional to the square of  $H$  (quadratic Zeeman effect), but in general the law determining the separation of the components is of a more complicated nature, in which case the Paschen-Back effect, or a related effect, occurs. The pattern is no longer symmetric about the field-free line, and strong intensity anomalies occur. A typical Paschen-Back effect occurs in a spectral multiplet when the Zeeman components of neighboring multiplet components approach each other. It would occur in the example of Fig. 2 if the field were so greatly increased that the right component of the left line came close to the left component of the right line. The mechanism of the typical Paschen-Back effect is that the applied magnetic field breaks the magnetic coupling of the electron spin with the magnetic moment of the electron orbit.

**Interpretation.**—Lorentz in 1896 gave a complete theory of the normal Zeeman effect based on the then prevalent classical electron theory. This theory recognizes moving electrons in the atom, the frequencies of their motion corresponding to the observed frequencies of the spectrum lines. In a magnetic field, onto the motion of the electrons there is superimposed the so-called Larmor precession about the axis of the field. This pre-

cession has a frequency  $\omega_L = eH/4\pi mc$ , the so-called Larmor frequency. The original frequency  $\omega_0$  is modulated by the Larmor frequency so that the three frequencies  $\omega_0$ ,  $\omega_0 + \omega_L$ ,  $\omega_0 - \omega_L$  are observed.

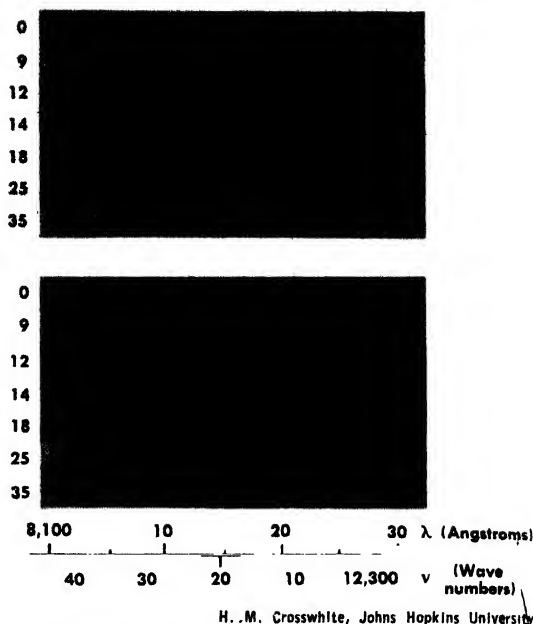
The theory of Lorentz could give no account of the anomalous Zeeman effect. However, the subsequent introduction of electron spin together with the quantum theory of the atom led to a complete account of all details of any observed Zeeman effects. According to the quantum theory, any spectrum line of frequency  $\nu$  is due to a transition between two states of energies  $E'$  and  $E''$  respectively according to the fundamental relation  $h\nu = E' - E''$ , where  $h$  is Planck's constant. Both the upper and lower states are modified in the magnetic field, but, because of electron spin, in different ways.

**Nuclear Magnetic Resonance.**—The atomic nucleus usually has a small magnetic moment that causes a spectrum line to be broken up into several narrowly spaced hyperfine-structure components. These components show a very characteristic Zeeman effect. When the transitions are those between the hyperfine-structure components, the effect is called nuclear magnetic resonance (NMR). NMR is now used extensively for the analysis of materials.

**Paramagnetic Resonance.**—The transitions between the adjacent Zeeman components of one electronic state have the frequency  $\nu = ag$ , where  $g$  is a factor that expresses the influence of the electron spin. For reasonable field strengths (several thousand gauss) these transitions are in the microwave region, where the experimental techniques are quite different from those used in optical spectroscopy. The transition frequencies (resonance frequencies) can be measured directly with high accuracy, so that extremely accurate values of  $g$  can be obtained. These have led to refinements in the theory of magnetic moments. A Zeeman splitting occurs only if the state has a magnetic moment, which is synonymous with saying that the state is paramagnetic. A substance is customarily but not exclusively called paramagnetic if its ground state is paramagnetic, and the paramagnetic-resonance experiments are usually carried out with such substances.

**Zeeman Effect in Molecular Spectra.**—The Zeeman effect in atoms results from the fact that the magnetic moment is oriented by the magnetic field and precesses about it. If a molecule has a magnetic moment, the latter is moved around by the rotation of the molecule, and this movement interferes with the orientation in the magnetic field. For this reason substantial Zeeman effects are the exception in molecular spectra. They occur when the molecule rotates not at all or very little, or when the electronic shell is so loosely attached to the nuclear frame that the shell can move independently under the influence of the magnetic field.

**Zeeman Effect in Crystals.**—There are crystalline solids that have sharp absorption or emission lines, especially at low temperatures. (The emission spectrum of a solid is usually a fluorescence spectrum, although other types of luminescence spectra can occur.) These are primarily salts of rare earths and to a lesser extent salts of the iron group and other transition elements. These crystal lines usually exhibit interesting Zeeman effects that depend on the orientation of the crystals. Fig. 3 shows a fairly complicated example of a crystal Zeeman effect.



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Zeeman effect in absorption spectrum of crystalline dysprosium chloride. Numbers on left indicate strength of magnetic field in kilogauss. In upper part magnetic field is parallel to crystal axis; in lower part, perpendicular.

**Applications.**—Some of the more direct applications of the Zeeman effect are given in the following paragraphs. There are numerous others.

**Analysis of Spectra.**—For the analysis of complicated spectra, the knowledge of the quantum numbers associated with each spectrum line is very important. The Zeeman splittings depend on these numbers in a very pronounced way, so that the analysis of an observed Zeeman pattern will give the desired quantum numbers. The Zeeman effect, therefore, has always been an important tool for the analysis of complex spectra.

**Measurement of Magnetic Fields.**—For a known spectrum line the splittings can be used to obtain the strength  $H$  of the magnetic field. This is of no great importance if there are independent methods for measuring the field. However, for very hot or electrically disturbed substances (plasmas) and for inaccessible bodies (the sun and stars), the Zeeman effect offers the only method for magnetic field strength measurements. In this way it was found that sunspots have a considerable magnetic field but that there is a smaller but noticeable field on other parts of the surface of the sun and other stars. Ingenious modifications of the Zeeman effect have been used by astrophysicists to demonstrate the small magnetic fields of stars.

**Relation of Zeeman Effect to Paramagnetic Properties.**—Paramagnetism of a substance is caused by the fact that the constituent atoms, molecules, or ions have a net magnetic moment (see MAGNETISM—Diamagnetism and Paramagnetism). This same property is also responsible for the Zeeman effect. There is thus a close relationship between the Zeeman effect and the paramagnetic susceptibility. In fact, when the former is known, the susceptibility can be completely calculated. The inverse is much more difficult. The simplest case is when there is only one state that, in a magnetic field, is split into two com-

ponents with separation  $\alpha$ . In this case the magnetic susceptibility at the absolute temperature  $T$  is  $3Ns^2\beta^2/4kT$  (Curie's law), where  $N$  is the number of paramagnetic ions per unit volume,  $k$  is Boltzmann's constant, and  $\beta = eh/4\pi mc$  is the so-called Bohr magneton. This case is realized in many crystals when the magnetism is due to the electron spin only. When there are more than two Zeeman components or several levels occupied, or when the substance is anisotropic, the formulas are somewhat more complex; however, in this case also the susceptibility can be obtained from the Zeeman splittings by a relatively easy calculation.

When neighboring paramagnetic ions influence one another, the situation becomes more complicated, and this is reflected in the Zeeman effects. If the mutual interaction is large, the substance is ferromagnetic. Thus far the Zeeman effect of ferromagnetic substances has been studied only in a few exceptional cases.

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**ZEILA**, za'lā (formerly ZEYLA), town, Somalia, on the Gulf of Aden, 25 miles southeast of Djibouti, French Somaliland. Formerly one of the largest centers of the slave trade on the East African coast, it now concentrates on cattle and sheep raising, pearl fishing, and exportation of hides, skins, gums, and coffee; imports include dates, silks, cotton, and rice. After the decline of Aksum (Axum) in the 6th century A.D., Zeila became the most important port for the trade of the Abyssinian highlands. In the 15th century it was occupied by the Turks, but in 1516 they were displaced by the Portuguese, who burned the town. For the next three centuries the Arab sherifs of Mocha (Mukha) were in control, succeeded by the Egyptians in 1870 and the British in 1884. The British protectorate ended with the creation of the independent Republic of Somalia in 1960. Most of the inhabitants are of mixed Hamitic and Semitic blood. The population varies, according to the seasons, between 3,000 and 7,000.

JOHN RALPH WILLIS, JR.

**ZEISBERGER**, zis'bûr-gər, Ger. tsis'bër-gar, David, American-Moravian missionary among the Indians: b. Zauchtenthal, Moravia (now in Czechoslovakia), April 11, 1721; d. Goshen, Ohio, Nov. 17, 1808. Educated at Hermhut, Saxony, the headquarters of the reorganized Moravian Church, he emigrated to Savannah, Ga., in 1738 with the aid of Count Nikolaus Ludwig von Zinzendorf to join the Moravian colony there. He soon proceeded to Pennsylvania, where he helped to found the towns of Bethlehem and Nazareth in 1740-1741. Zeisberger learned the Indian language, lived among the people, made many converts to the Moravian faith, and played an important role in keeping peace between the Indians and white settlers on the Pennsylvania frontier. Moving westward, in 1772 he founded the Christian Indian village of Schoenbrunn in the Tuscarawas Valley, the first town established in

Ohio, which has been reconstructed in Schoenbrunn Memorial State Park. This was soon followed by the nearby settlement of Gnadenhutten and others. During the American Revolution, however, the Indians were regarded with suspicion by both Americans and British, and the settlements were broken up. Zeisberger was made prisoner in 1781 by the British, and his Gnadenhutten converts were massacred the next year. After his release in 1782, he set up missions in Michigan, Canada, and Ohio. In 1798 he settled in Goshen with some of his Indian followers and spent the rest of his life there.

Zeisberger published *A Delaware-Indian and English Spelling-Book* (1776); *A Collection of Hymns for the Use of the Christian Indians* (1803); and *Sermons to Children* (1803), in the Delaware language. Long after his death his *Diary* (1885) was brought out, and Zeisberger's *Indian Dictionary, English, German, Iroquois—the Onondaga and Algonquin—the Delaware* (1887).

**ZEISS**, tsis, Carl, German optician and manufacturer of precision optical instruments: b. Weimar, Germany, Sept. 11, 1816; d. Jena, Dec. 3, 1888. Educated for the medical profession, he founded the Carl Zeiss factory at Jena in 1846, at first specializing in microscopes. In 1866 he appointed Ernst Abbe (q.v.), the physicist, then an instructor at the University of Jena, as director of research, taking him into partnership in 1875. With Abbe's assistance in improving Zeiss' earlier instruments, the firm became world famous for the optical instruments it produced. After Zeiss' death, Abbe succeeded him as sole owner, reorganizing the business on a cooperative basis as Carl-Zeiss-Stiftung with branches throughout both hemispheres. It broadened its activities to include cameras, telescopes, and, just before and after World War I, planetariums (see also PLANETARIUM). Some of its other early contributions were Abbe's condenser for the compound microscope (1870), his refractometer for measuring the refractive index of substances (1874), the anastigmatic camera lens (1889), and the stereoscopic range finder (1893).

**ZEIST**, zist, town, the Netherlands, in Utrecht Province, five miles east of Utrecht. The attractive countryside, where rolling wooded land meets the flat polders, has made it a residential center and a popular summer resort, and there are many villas in the neighborhood, most of them modern. There is some manufacturing. A historic castle has been converted into a Moravian monastery. The Moravian settlement dates from 1746. Pop. (1961) 52,353.

**ZEITZ**, tsits, city, Germany, on the Weisse Elster River, 25 miles southwest of Leipzig. Its industries include brewing and the manufacture of pharmaceuticals, machinery, and pianos. A 10th century church, the 16th century city hall, and the 17th century Moritzburg castle (replacing one originally built in the 10th century) are points of interest. Zeitz was the seat of a bishopric, established by Emperor Otto I, from 968 to 1028, and was the capital of the duchy of Saxe-Zeitz from 1563 to 1718. It passed under the control of Prussia in 1815. After World War II it was included in the German Democratic Republic (East Germany); from 1952 in Halle District. Pop. (1960) 45,200.



**ZELAYA**, sā-lā'yā, **José Santos**, Nicaraguan statesman: b. Managua, Nicaragua, 1853; d. New York, N.Y., May 17, 1919. A leader of the Liberal Party, he came to power as president in 1893 after a successful revolution against the Conservative incumbent, Roberto Sacasa. One of his first acts was to annex (1894) the previously autonomous Mosquito Indian reserve, forming the department that now bears his name. Zelaya did much to modernize the economy of Nicaragua, but his program aroused violent Conservative opposition, and he resorted more and more to dictatorial rule. It was also his ambition to unify the countries of the area, and in 1895 he succeeded in forming the Greater Republic of Central America, with Honduras and El Salvador; but this soon fell apart. Zelaya's regime became increasingly embroiled with its neighbors and resented United States efforts to intervene, although a conference in Washington in 1907 brought a measure of peace with the formation of the Central American Court of Justice. In 1909 a Conservative revolution against him received support from the United States after two American citizens fighting with the Conservatives were executed. Zelaya was compelled to resign and went into exile. See also **CENTRAL AMERICA, DIPLOMATIC RELATIONS WITH; NICARAGUA-10. History.**

**ZELAYA**, department, Nicaragua, in the eastern part of the country, on the Caribbean Sea, between Cabo Gracias a Dios Territory on the north and Río San Juan Department on the south. Its area of 21,616 square miles constitutes about 40 percent of the total land area of the country. The capital is Bluefields, a Caribbean port at the mouth of the Escondido River. Other rivers draining into the Caribbean are the Huahua, Prinzapolca, the Río Grande, and Punta Gorda. The Corn Islands (q.v.), off the coast, are leased to the United States.

The inhabitants of the department are mainly Mosquito (Miskito) Indians. The terrain is thickly forested, except along the coast, which is swampy. Mahogany, pine, and balsam woods are cut for export, and significant quantities of gold and copper are mined. Sugarcane and other agricultural products are grown.

The area was a British protectorate until 1860, when it was made an autonomous Indian reserve under Nicaraguan administration. It was annexed by Nicaragua in 1894, during the presidency of José Santos Zelaya (q.v.), for whom it is named. Pop. (1960) 72,214.

See also **MOSQUITO COAST; NICARAGUA.**

**ZELLA**, dzēl'lä, oasis, Libya, in Fezzan Province, in the Sahara, in the central part of the country, 105 miles southeast of Hun (Hon) and about 170 miles south of the Mediterranean coast. It is a caravan center and road terminus. The population raises figs, dates, barley, and cattle. During the time of El Magrizi (1365-1442), the Islamic empire of Kanem extended from Zella southwestward to Gao on the Niger River. Pop. (1954) 2,047.

JOHN RALPH WILLIS, JR.

**ZEMSTVO**, zēmst'vō; Russ. zym'stvō, the name for any of the provincial and county legislatures established in most of European Russia by Czar Alexander II in an edict of Jan. 13, 1864.<sup>1</sup> Estate owners, peasant villages, and town burghers were

<sup>1</sup> All dates are New Style.

each authorized to elect a fixed number of representatives to a three-year county zemstvo. The county zemstva (zemstvos) within a province then elected a provincial zemstvo. Executive boards were chosen by both county and provincial zemstva to provide legislative leadership. The zemstva had the power to levy minor taxes, fostered agricultural development, and took charge of roadbuilding, welfare work, local schools, and public health. Similar legislatures called city dumas were established by Alexander II in urban areas by an edict of 1870.

Zemstvo power, never strong, was greatly weakened by Czar Alexander III in an edict of June 24, 1890, which authorized provincial governors to choose the peasant delegates to county zemstva. By the same edict the provincial governors, who were appointees of the czar, were empowered to veto decrees of both county and provincial zemstva. In 1894 zemstvo leaders met in the first all-Russian zemstvo congress, but Czar Nicholas II forbade such congresses in the future. Beginning in 1901, however, zemstvo leaders held regular national meetings in secret. During 1904 this secrecy was discarded, and a zemstvo congress openly demanded that the czar authorize a national legislature and grant civil rights to the Russian people. The Union of Unions, formed in 1905 by zemstvo employees, played an important role in the revolution of that year. When Nicholas stopped this revolution by permitting the election of a national legislature (Duma) with limited power, zemstvo leaders formed the Constitutional Democratic (Kadet) Party, which wielded great influence within the Duma.

When World War I began in 1914, an all-Russian Union of Zemstva was formed, which contributed much to the war effort. The provisional government, which ruled Russia from March to November 1917 after the abdication of the czar, created new zemstva in Siberia and Central Asia. The Bolshevik Revolution of Nov. 6-7, 1917, however, gave power to dictator Vladimir I. Lenin, who on Jan. 6, 1918, destroyed the zemstvo system.

The zemstva were the first attempt in modern Russian history to achieve local democracy. They were capable and conducted much local improvement. Undemocratic czars restricted this democracy, however, and it was ended by communism.

ELLSWORTH RAYMOND.

**ZEN BUDDHISM**, zēn bōō'dīz-əm, a Buddhist sect that probably originated in India but is usually associated with the religious history of China and Japan. The term Zen is Japanese for "meditation"; the Chinese equivalent is Chan. A tradition, sometimes contested, ascribes its introduction in China to the Indian monk, Bodhidharma, in 520 A.D. Strongly influenced by Taoist mysticism, Zen flourished in China during the late T'ang dynasty (618-906) and for about 500 years thereafter, and made its way into Japan. With the decline of the old Japanese aristocracy, patrons of earlier esoteric Buddhist sects, and the rise of the warrior class in the 12th and 13th centuries, a sense of insecurity prevailed. Under these conditions, Zen struck permanent roots, as did the popular Amida Buddhism and the nativist sect of Nichiren. See **JAPAN-13. Religion** (Indigenous Buddhism: 1200-1600).

In both its Chinese and Japanese practice, Zen represented a reaction against the histori-



Bodhidharma, a monk who is said to have brought Zen Buddhism to China from India about 520 A.D.

cally developed Buddhist sects and a reversion to the pristine teachings of the Buddha himself. (See **BUDDHA AND BUDDHISM**). Disdaining the worship of deities, rejecting scriptures, and scorning rituals, it placed the responsibility of achieving enlightenment (*satori*) upon the individual. Through meditation, it was believed, man might secure insight into the nature of reality by intuitive flashes; methods of attaining enlightenment differed, however, in Rinzai and Sōtō Zen, the two principal schools. The simplicity of technique and spirit of self-reliance of Zen strongly appealed to Spartan warriors in Japan, while its capacity to sharpen perceptive powers attracted intellectuals and artists. But its apparent heterodoxy also evoked the suspicion and even opposition of the more popular Buddhist sects.

With the ascendancy of Neo-Confucianism, officially sponsored from Sung (960-1279) and especially Ming (1368-1644) times on, Chan and Buddhism in general gradually declined in China. In Japan, however, Zen rose to new peaks of influence during the turbulent age of the Ashikaga shogunate (1338-1573), pervading art, literature, and drama. (See **JAPAN-16. The Fine Arts: Ashikaga; PAINTING-Eastern Art: Japanese Painting.**) During the later Tokugawa shogunate (1603-1867), an era of tranquillity, the appeal of Zen slackened. In the philosophical and psychological upheaval following World War II, however, Zen has enjoyed a domestic revival in Japan as well as a newborn popularity in the West. The Zen of the "beatnik," esteeming nonconformity and self-indulgence, is, however, a blatant perversion of the philosophy.

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**ZEND-AVESTA**, zēnd ə-vest'ə, or **AVESTA**, the sacred book of Zoroastrianism, the ancient Persian religion that is still practiced by the Parsis of India and the Zardoshtis of Iran. The book contains the teachings of Zoroaster, hymns, prayers,

invocations, and liturgical, legal, and mythical materials. The Avesta is written in the Avestan language, an old Iranian language of the Indo-European family, closely akin to Sanskrit. The Avestan script was designed for this purpose about the 6th century A.D., based on the Middle Persian script, which in turn was derived from the Aramaic alphabet.

**Components.**—The extant Avesta is but a fragmentary remnant of what had been a much larger collection of religious writings. In its present form it is used chiefly for liturgical purposes, and contains the following parts:

(1) *Yasna* (sacrifice, worship), the main liturgical portion of the Avesta, including also the *Gathas* (songs), a collection of 17 metrical hymns, which are the oldest and the most important part of the Avesta. These poems are written in a more archaic form of Avestan and are believed to be the work of Zoroaster himself. They contain the fundamental teachings of the prophet as revealed to him by Ahura Mazda (Ormazd, Ormuzd), the supreme deity. The *Gathas* are mainly concerned with the dualism of good and evil, the duty of man in the face of this conflict, its ultimate outcome, and the final victory of Ahura Mazda and the forces of good, leading to the realization of a kingdom of heaven. They are remarkably free from references to liturgical and ceremonial observances, as well as to the Iranian deities and their cults, which appear in some of the later portions of the Avesta.

(2) *Visparad* (Vispered, all the lords), a minor liturgical text resembling *Yasna* in form and content. It consists mainly of invocations and praises of Zoroastrian deities and saints.

(3) *Yashts* (worship, hymn of worship), a collection of poetical hymns, mainly in verse, extolling Zoroastrian deities or angels. In composition the *Yashts* are later than *Yasna*, but in content they are older, revealing the polytheistic background of the Aryan religion and its naturalistic pantheon, appearing here in a Zoroastrian guise. Among the main *Yashts*, 21 in all, are those concerning the goddess of the waters; Mithra (Mithras), the old Indo-Iranian deity, representing in the Avesta the god of contract, truth, and light; and the departed souls of the righteous. The *Yashts* are of considerable poetic merit and particularly important from a mythological point of view.

(4) *Vendidad* (originally *Videv-dat*, law against false deities or demons), mainly a detailed priestly code, particularly concerned with the rituals, regulations, penalties, and expiations involved in purification. The first two chapters, however, are divorced both in content and style from the rest. The first chapter deals with a dualistic account of the creation of the regions of the earth. The second chapter tells the story of Yima, the first ruler of the world (in Vedic tradition, the first man), who is instructed by Ahura Mazda to save mankind, plants, animals, and fire from the approaching disastrous winter and destructive flood.

(5) *Minor Texts*. These are shorter, fragmentary pieces including prayers, litanies, invocations, denunciations, and supplications, often drawn from the other parts of the Avesta, for use both by the laity and the clergy.

(6) *Fragments*. These are disconnected pieces containing prayers, invocations, blessings, praises, and eschatological pieces surviving from the lost parts of the Avesta.

**History.**—The Avesta was written over a long period of time. The date of its oldest part, the Gathas, is connected with the date of Zoroaster, which has been the subject of conflicting conjectures. The date of the Gathas, however, is definitely not later than the first half of the 6th century B.C., a date supported by both the Zoroastrian tradition and the more competent scholars. The most recent parts of the Avesta may have been written as late as the 4th century A.D. under the Sassanid monarch, Shapur II. The Avesta varies considerably, therefore, in content and style, reflecting several phases of development in the Zoroastrian religion.

The fact that the greater part of the Avesta has been lost is deduced not only from Persian, Greek, and Syriac sources, but also from the fragmentary nature of the extant Avesta. *Dinkart*, a compendium of the Zoroastrian religion written in the 9th century A.D., gives a summary of the content of the 21 books of the Avesta that were extant in Sassanid times (c. 226–641 A.D.), although they were not all preserved at the time *Dinkart* was compiled. It is clear that the Avesta was of an encyclopedic nature, embodying both purely religious writings and the lore and science incorporated in the Zoroastrian religion. It suffered the loss of some of its parts in Alexander the Great's invasion of Persia (late 4th century B.C.) and the following period. Attempts were made later to restore, reconstruct, or enlarge the Avesta, notably under the Arsacid Vologesus I (r. 51?–77 A.D.), and the Sassanids Ardashir I (d. 241 A.D.) and Shapur II (r. 309–379 A.D.). The greater part of the Avesta was lost after the Arab invasion of Persia (7th century) and the advent of Islam, when the religion as well as the script of the country was changed and the language modified.

The Avesta was first brought seriously to the attention of the Western World through the efforts of a Frenchman, Abraham Hyacinthe Anquetil-Duperron (q.v.), who arrived in India in 1755 and returned to France seven years later, after surmounting innumerable obstacles, with manuscripts of the Avesta. His translation appeared in Paris in 1771 under the title, *Zend-Avesta, Ouvrage de Zoroastre*. Since then, Western scholarship has done much to provide a clearer understanding of the Avesta, which presents many difficulties.

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**ZENGER**, zēng'ər, John Peter, American printer: b. Rhenish Palatinate, Germany, 1697; d. New York, N.Y., July 28, 1746. He was brought to New York City as an immigrant in 1710 and apprenticed to the colonial printer William Bradford from 1711 to 1719. After seeking business opportunities elsewhere and settling temporarily in Maryland, he returned to New York, became a freeman of the city in 1723, and joined Brad-

ford in a brief partnership in 1725. The following year he set up his own printing shop, supported largely by Dutch-language work and controversial matter which Bradford, as official printer for the provincial government, could hardly accept.

By the early 1730's Zenger's services were in special demand. A strong antiadministration popular party had been organized to oppose and expose the unscrupulous activities of a new and grossly incompetent governor, Col. William Cosby. The party leaders—notably the brilliant lawyer and journalist James Alexander (q.v.) and former chief justice Lewis Morris, whom Cosby had removed from office—engaged Zenger to print the *New-York Weekly Journal* in opposition to the government-controlled *New York Gazette*, published by Bradford. The first issue of the *Weekly Journal* appeared Nov. 5, 1733. Zenger assumed full responsibility as publisher, and all contributors were anonymous. Alexander apparently wrote and edited most of the articles, satirical advertisements, and other items printed.

The governor was unable to secure a grand jury indictment against the printer but finally had a warrant for arrest issued through the executive council. Zenger was imprisoned on Nov. 17, 1734, charged with seditious libel, and held under excessive bail for almost nine months; but professing "the liberty of speaking through the hole of the door to my wife and servants," he continued to issue his paper. At the trial that followed he was acquitted, and he eventually became public printer for both New York and New Jersey. After his death the *Weekly Journal* was continued by his wife until 1748 and by his son John Zenger until 1751.

Zenger had limited command of the English language, but he was a courageous printer and patriot. His ultimate fame as a defender and symbol of freedom of the press owes much to the greatness and eloquence of such men as James Alexander and Andrew Hamilton, who were responsible, respectively, for the success of his journal as well as his trial.

#### THE ZENGER TRIAL

The Zenger case was the most important trial for seditious libel during the colonial period in America. When it was brought to the attention of the court in April 1735, his lawyers, James Alexander and William Smith, questioned the right of the Cosby-appointed chief justice and his associate to preside over the case. As a result they were debarred, and John Chambers was named counsel for the defense. The trial was set for Aug. 4, 1735, and an acceptable jury was finally selected despite illegal maneuvering by the governor's faction. The attorney general and chief justice were thrown off guard completely, however, when Andrew Hamilton, a distinguished attorney from Philadelphia, stepped from among the spectators to take over as counsel for the defense.

Hamilton introduced a completely new approach to the issue, admitting the publication of the alleged libels but denying that they were false and defending the right of publication of matters "supported with truth." To accept this challenge the chief justice would have faced a public review of the governor's activities. Instead he insisted that the jury was required to determine only the fact of publication and that the court would decide the question of libel. Hamil-

ton had no other recourse than to turn to the jury and inform them, despite the explicit instructions of the chief justice, that it was their right to "determine both the law and the fact"; whether there was "falsehood in Mr. Zenger's papers" and whether he was guilty of libel. In his eloquent peroration Hamilton made clear that the "liberties of their country" were at stake since "a bad precedent in one government is soon set up for an authority in another"; and he called on the jury to secure "that to which nature and the laws of our country have given us a right—the liberty of both exposing and opposing arbitrary power (in these parts of the world at least) by speaking and writing truth."

The decision of the jury was "not guilty," and Zenger was released the following day. The next year he published *A Brief Narrative of the Case and Trial of John Peter Zenger*, prepared by James Alexander. In 1953 a John Peter Zenger Memorial Room was established in New York City as part of the Federal Hall Memorial Museum on Pine Street. In retrospect the wisdom and foresight of Andrew Hamilton's defense are even more remarkable in view of the fact that truth as a defense against criminal libel was not generally guaranteed by constitutional law in the United States and Great Britain before the 19th century. Today it is a basic principle of freedom of the press.

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**ZENITH**, zē'nīth, an astronomical term of Arabic origin, designating the point directly overhead on the celestial sphere. The direction of the *astronomical zenith* is given by the extension of a plumb line; it is therefore affected by local deviations of the vertical caused by the earth's rotation and by uneven distribution of masses in the surrounding terrain. The zenith distance of a celestial object, the complement of its altitude, is its angular distance from the zenith, measured by the arc of a vertical circle which intersects the object and the zenith. The *geocentric zenith* is obtained by extending the line passing through the earth's center and the observer; its position differs somewhat from that of the astronomical zenith because it is independent of local deviations of the vertical and because the earth is not strictly spherical. The point underfoot diametrically opposite the zenith is called the *nadir*.

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**ZENITH TELESCOPE**, an instrument used both in field astronomy and at fixed observatories for the accurate determination of latitude. The instrument consists essentially of a telescope mounted at its middle on one end of a counterweighted horizontal axis, which in turn is pivoted at its middle on a vertical pillar, permitting the axis to revolve in azimuth, or around the horizon. The telescope itself can rotate in a vertical plane at the end of the axis, and a circle attached to the axis permits it to be pointed to any al-



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The Zenger trial in New York City in 1735 helped set the precedent for freedom of the press.

titude or zenith distance (the complement of the altitude). A very sensitive level is also attached.

The instrument is used in the following manner. The approximate latitude of the place must be known, either from a sextant or from some other type of observation. Two stars, whose declinations are accurately known, are chosen so that one crosses the meridian about as far north of the zenith as the other does south. Their right ascensions should not differ by more than 15 minutes. Their actual zenith distances will then be  $Z_1 = \delta_1 - \phi$  and  $Z_2 = \phi - \delta_2$  respectively, where  $\delta_1$  is the declination of the northern star,  $\delta_2$  that of the southern star, and  $\phi$  the desired latitude. The telescope is then set and clamped at such a zenith distance that both stars will cross its field not more than about half a radius from the central horizontal wire. As it crosses the meridian, the distance of the first star from the central wire is measured with a filar micrometer. Without disturbing the angle the telescope makes with the vertical, it is then rotated  $180^\circ$  and the second star is similarly observed. Combining the two equations, we then get

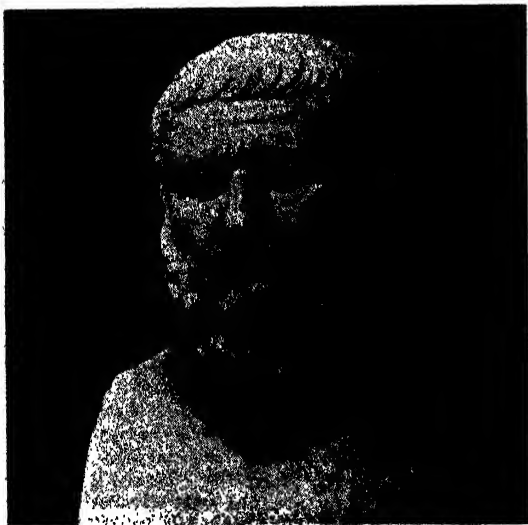
$$\phi = \frac{1}{2} (\delta_1 + \delta_2) + \frac{1}{2} (Z_2 - Z_1).$$

The declinations are known from the star catalogs; the zenith distances have just been determined; hence we solve at once for  $\phi$ , the latitude. Since refraction errors become greater at large zenith distances, the method is most accurate for stars within  $15^\circ \pm$  of the zenith, while  $30^\circ$  is about the limit. Known as the Horrebow-Talcott method, it was first practically employed in 1832-1836 by Capt. Andrew Talcott of the United States Engineers in the Ohio-Michigan state boundary survey.

A zenith telescope in which the whole instrument floats in a basin of mercury has been devised by B. Cookson and used at the Royal Greenwich Observatory. The observations are made photographically by allowing the stars to trail across the field. The reductions are of the same type as with the visual type of instrument. Older methods of latitude determination, which employed the prime vertical instrument or zenith tube, are no longer in general use; the photographic zenith tube has largely superseded the zenith tube.

**ZENJAN**, zēn-jān', or **ZINJAN**, zīn-jān', or **ZANJAN**, zān-jān', city, Iran, on the Senjan River, 180 miles northwest of Teheran, in the First Ostan (Gilan). Once important as the principal center of the former Khamseh Province, it is now primarily an agricultural market (fruit, wheat), with some manufacture of cutlery, rugs, and cotton goods. It is situated on a railroad and has an airfield. The population is largely Turkic. Pop. (1956) 47,159.

**ZENO**, zē'nō, or **ZENON**, zē'nōn, Byzantine emperor: b. Rousoumlada, Isauria, Asia Minor, 426; d. Constantinople (now Istanbul, Turkey), April 9, 491. An Isaurian chieftain, originally called Tarasicodissa, he changed his name to Zeno about 467 on his political marriage to Ariadne, daughter of Emperor Leo I. In 469 the emperor appointed him master of the soldiers in the Orient (commander of the armies in western Asia) and consul. He usurped the throne in 474 at the death of Leo's infant grandson, Leo II.



The Mansell Collection

Ancient bust of the Byzantine emperor Zeno.

Zeno's reign was marked by internal commotions and foreign wars. For 20 months during 475-477 he was deprived of rule by Basiliscus, a usurper. In 478 he bribed Ostrogothic invaders of the empire to withdraw. In 479 he quelled a revolt in Constantinople by buying off the troops of its leader, his brother-in-law Marcian, and again purchased peace from the Ostrogoths, who had marched upon the capital at news of the uprising. Zeno repelled a third incursion of Ostrogoths in 481 by bribing Theodoric the Great, their king and the future ruler of Italy. From 484 to 488 the emperor withstood another revolt, headed by Illus, his master of the offices. Toward the end of this rebellion Zeno persuaded Theodoric, who was about to aid Illus, to invade Italy (488) and oust Odoacer (Odovacar), who had deposed the last Western Roman emperor, Romulus Augustulus, in 476 and was governing Italy—nominally as vice regent of the Eastern Roman emperor.

In ecclesiastical affairs Zeno was noted for his publication of the *Henoticon*, or *Decree of Union*, in 482. This formula reconciled the

moderate Monophysites (q.v.) with the orthodox Eastern Christians, but its issuance inaugurated the first important schism (484-518) between the Greek and the Roman churches.

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**ZENO**, dzā'nō, **Apostolo**, Italian dramatist, critic, and literary historian: b. Venice, Italy, Dec. 11, 1668; d. there, Nov. 11, 1750. He was a co-founder (1710) of the critical periodical *Giornale dei letterati d'Italia* and court poet and historiographer to the Holy Roman emperor Charles VI at Vienna (1718-1729). Zeno's operatic librettos attained high literary quality, inspiring the efforts of such composers as Alessandro Scarlatti, Antonio Vivaldi, and Giovanni Battista Pergolesi. For many years he was Italy's leading dramatic poet. Since his death, even greater importance has been assigned to his scholarship and criticism, which includes biographical prefaces to several editions of the works of other Italian writers.

**ZENO**, Niccolò and Antonio, Venetian navigators: fl. late 14th century. Knowledge of the adventures of these two brothers derives mainly from a narrative purported to be based on their letters but first published in Venice in 1558, more than 150 years after the letters were written. According to the narrative, which has been doubted by most historians, the brothers entered the service of Henry Sinclair, Scottish earl of Orkney, about 1390. In 1393 or 1394 Niccolò is said to have sailed from the islands north of Scotland to the east coast of Greenland, where he visited a monastery; he died a year later, at Orkney.

About 1398 Antonio Zeno supposedly accompanied Sinclair on a westward voyage inspired by the reports of a fisherman who claimed he had spent several years in "Estotiland," somewhere southwest of Greenland. The informant pictured the country as abounding in gold and inhabited by "very intelligent people." Sinclair's expedition is said to have reached harbor in a new land which may have been Nova Scotia. Antonio soon returned, while Sinclair remained to explore the territory and to produce detailed descriptions of it, since lost. Antonio died in Venice about 1406. The 1558 account of this purported pre-Columbian discovery of the New World included an extremely inaccurate map of the North Atlantic, which confused mariners and geographers for more than a century.

**ZENO OF CITIUM**, zē'nō, sīsh'ē-am, Greek philosopher: b. Citiium, Cyprus, c. 335 B.C.; d. Athens, Greece, c. 263 B.C. Probably of Phoenician origin, he was shipwrecked near Piræus, the port of Athens, in 313 and then settled at Athens. After attending lectures by leading professors of the several Athenian philosophical schools and studying their doctrines, he began about 300 to teach his own tenets in a public hall, the Stoa Poikile (Painted Porch), whence his system was named Stoicism. Zeno's presentation was so popular that he soon attracted many auditors, and he continued to teach there for almost 40 years, until his death. Zeno's exemplary life was so esteemed by the Athenians that they offered him citizenship, which he declined from fidelity to his birthplace. Another admirer, Antigonus II Gonatas, king of Macedon



(c. 276–239 B.C.), invited him to transfer his activity to the Macedonian capital (Pella), a request that Zeno refused.

Zeno propagated his doctrine also in numerous treatises, of which only brief and isolated excerpts are extant. Among his works are recorded: *On Life According to Nature*, *On Human Nature*, *On Emotions*, *On Duty*, *On Law*, *On Vision*, *On the Whole World*, *On Signs*, *On Varieties of Style*, *Ethics*, *Pythagorean Questions*, *Rhetoric Universals*, and *The State*. Besides these, he wrote on education and poetry and left memoirs.

**Teachings.**—Reconstruction of what Zeno taught is extremely difficult for two reasons: (1) so little of his literary production exists that only an imperfect and partial idea of his doctrine can be constructed; and (2) his successors' literary activity during the century after his death, in controversy with competing scholars of other schools, so obscured his original work that it can be determined only generally or by conjecture how Zeno gradually achieved the original outlines of Stoicism or how far he himself carried the school's solution of philosophical problems. Most of the extant definition, amplification, modification, and contradiction in Stoicism must be post-Zenonic, since Stoicism passed through three phases (early, middle, late) in its vigorous history from 300 B.C. to 200 A.D. After this the Stoic school ceased to exist as such; but having spread beyond the professional philosophers, it influenced the formation of the philosophy of the early Christian church fathers.

Zeno created a tripartite system divided into: (1) logic, including psychology and epistemology; (2) physics, including ontology and theology; and (3) ethics, including aesthetics and politics. He adapted his logic from the Cynic dogma of Antisthenes (c. 455–c. 360 B.C.) and the Megaric doctrine of Diodorus Cronus (fl. 300 B.C.); borrowed his physics mostly from Heraclitus (fl. 500 B.C.) and partly from Aristotle (384–322 B.C.); and acquired much of his ethics from the Cynics (q.v.). In his and his immediate successors' hands ethical doctrine so overshadowed logic and physics that it became the characteristic hallmark of Stoicism in antiquity and has persisted to the present as the most prominent part of the Stoic system.

Zeno's ethical teaching appears to have been based on the axioms: (1) that absolute law admitting no exception governs nature; and (2) that man's essential nature is reason. To the rational being the same act is both according to nature and according to reason; hence man must live according to nature, that is, according to his whole nature and not according to a part of it. As virtue is the life according to reason, so morality is simply rational action; passion and emotion are essentially irrational and must be extirpated. Virtue is the only good, vice is the only evil, everything else—poverty or wealth, health or pain, life or death—is indifferent. All virtues are equally good, and all vices are equally evil—there are no degrees: one is either wholly virtuous or wholly vicious. This celebrated paradox is qualified by the profession that the prime virtue is wisdom, whence evolve all other virtues. The wise man is the good man, good not for the sake of pleasure, but of duty; and being secure in his virtue, he is happy.

See also STOICISM.

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**ZENO OF ELEA**, zé'nō, ē'lē-ə, Greek philosopher: b. Elea (Velia), Italy, c. 490 B.C.; d. there, c. 430 B.C. He was a favorite pupil and friend of Parmenides (q.v.), whose doctrines he defended and whose political schemes he shared. About 450 B.C. Zeno accompanied his mentor to Athens, where he propounded the principles of the Eleatic school (q.v.), of which he was one of the last important exponents. He soon returned to Elea, where he later died in an attempt to oust the city's tyrant.

Of Zeno's philosophical treatises, only rare fragments remain in ancient authors' works, from which can be constructed something of his system. To support Parmenidean ontology, he proposed certain ideas about time and space. Since Parmenides had taught that the phenomenal world is illusory and false, that its essentials are alteration and multiplicity, and that true being has in it no plurality and is unchangeable, Zeno argued against multiplicity and motion and attempted to prove these to be impossible by showing that contradictory propositions follow from the assumption that they are real.

Zeno's argument against multiplicity may be summarized thus: (1) if the many exists, it must be both infinitely large and infinitely small; and (2) it must be both limited and unlimited in number. Of this fourfold argument against motion two illustrations are famous: (1) Achilles and the tortoise; (2) the flying arrow. The first assumes that Achilles, the swiftest of mortals, and the tortoise, notoriously a slow-moving reptile, run a race, in which the tortoise is given a start. Achilles never can overtake the tortoise because, when he has run to the point from which the tortoise started, he finds that the tortoise has advanced. Achilles then must run to the second point, only to find that the tortoise has reached a third point. This situation continues forever; although the interval continually diminishes, it never is eradicated entirely, and Achilles never will outrun the tortoise. This argument depends on a clear distinction between the measure of an interval and the number of points contained therein—a distinction that has been fully understood only in the 20th century.

The argument illustrated by the flying arrow states that an object cannot occupy two places at the same time. Therefore, at any particular moment during its flight the arrow is in only one place. But to be in one place is to be at rest. Therefore, the arrow is at rest at every moment of its flight. It follows that motion is impossible. This argument was not refuted until the 19th century, by application of the theory of assemblages and the theory of the functions of the real variable, which clarify the nature of space-time continua and of continuous functions.

Zeno's type of argument may be called the antinomy of infinite divisibility and is part of

his dialectic, which, according to Aristotle, Zeno invented. Certainly the conception of dialectic was as important in Zeno's system as it proved to be later in the philosophy of Plato, Kant, Hegel, Henri Bergson, and Einstein, who, among others, examined the essential contradictions inherent in our ideas of space and time. Zeno's merit was that by his illustrations he was the first to pose this important problem for later philosophy.

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**ZENO OF SIDON**, zé'nō, sī'dən, Greek philosopher: b. Sidon, Phoenicia (now Lebanon), c. 150 B.C.; d. probably at Athens, Greece, after 73 B.C. He directed the Epicurean school at Athens after 100 B.C. and is known chiefly from the philosophical dialogues of Marcus Tullius Cicero, who attended his lectures there in 79-78 B.C. In book 1 of *De natura deorum*, Cicero declares that Zeno's clear, cogent, and elegant style was misapplied to so trivial and stupid a set of tenets as those of Epicureanism (q.v.). Zeno himself was noted for his scornful abuse of other philosophers; Cicero quotes him as calling Socrates an Attic buffoon, despite Socrates' position as the first Greek to apply critical and philosophical thought to moral problems.

Zeno held (1) that happiness lies in the enjoyment of present pleasure and the assurance that such enjoyment will last throughout life or most of life without the intervention of pain; (2) that if pain intervenes it will be brief, if extreme, or will have more pleasure than ill in it, if prolonged; and (3) that reflection on these principles will make men happy, particularly if they have been content with previously enjoyed good things and dread neither death nor gods (Cicero, *Tusculanae disputationes*, book 3). Of Zeno's voluminous writings, only a few fragments like these remain. Posidonius, the scientific historian, Zeno's younger contemporary, composed a treatise against him, which has perished.

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**ZENOBIA**, zə-nō'bē-ə (Lat. SEPTIMIA, Aramaic BAT ZABBAI), queen of Palmyra: r. 267-272. She was one of the best-educated women of her age and an accomplished linguist; beyond this, little is known of her life before her marriage to Odenathus, who in 260 assumed the title of king of Palmyra (q.v.), a city at the northern edge of the Syrian Desert. To Zenobia's wisdom and courage are ascribed her husband's military successes against Persia from 262 to 267, when Odenathus, as a client king in command of Roman armies, preserved the Roman Empire's eastern frontier and even reconquered Mesopotamia for Rome.

On Odenathus' death, for which she was

probably responsible, Zenobia assumed the sovereignty in 267, styling herself queen, though nominally she acted as regent for their infant son, Septimius Vaballathus Athenodorus. At first she continued her husband's policy as defender of the empire and was prudent in administering the Palmyrene kingdom and in safeguarding Roman territory. But her ambition to reduce Rome's eastern provinces to her power soon caused her to embark upon the conquest of the Near East. She secured Syria in 268, occupied Egypt in 269, and in 270 overran nearly the whole of Asia Minor, where she established garrisons at strategic sites, all in professed protection of the imperial interests.



The Bettmann Archive

Zenobia, queen of Palmyra.

Success proved to be her ruin. Zenobia proclaimed Vaballathus emperor soon after Aurelian had been elected Roman emperor in 270, and the latter grew alarmed at her ambition. Marcus Aurelius Probus, Aurelian's general and future emperor, recovered Egypt. Aurelian personally reconquered Asia Minor and descended into Syria, where he defeated Zabdas, Zenobia's general, successively at Antioch (now Antakya, Turkey) and at Emesa (now Homs, Syria) in 271. He finally besieged Zenobia in Palmyra, which she defended bravely, but vainly. The city capitulated in 272 and was razed in 273.

Tradition tells that Aurelian captured Zenobia and Vaballathus in secret flight from the beleaguered capital and that when the Roman soldiers clamored for her death, she purchased her safety by sacrificing her ministers, among whom was Cassius Longinus (q.v.), the distinguished rhetorician, who had also been her tutor. Zenobia was taken to Rome in 274 to grace Aurelian's triumph, laden with costly gems, shackled hand and foot with gold fetters, and led by a gold chain. Through her conqueror's clemency, she was permitted to pass the rest of her life in retirement at a villa near Tibur (now Tivoli, Italy). Aurelian also pardoned her son and married her daughters into distinguished families.

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**ZENODORUS**, zē-nā-dōr'əs, Greek sculptor. fl. 65 A.D. He was noted for two huge statues adorned with silver-chased decorations. The first portrayed the Roman god Mercury and required 10 years to complete. His second famous colossus was of the Roman emperor Nero, who commissioned it for his palace (the Golden House) in Rome. This gigantic statue, altered to represent Apollo, later was reset near the Flavian Amphitheater, which from that time on was called the Colosseum.

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**ZENODOTUS**, zē-nōd'ō-təs, Greek scholar: b. Ephesus, Lydia, Asia Minor; fl. c. 325 B.C. As the first superintendent of the Alexandrian Library, he classified Greek epic and lyric poetry and edited some of it. Particularly important were his editions of Homer's *Iliad* and *Odyssey*, each of which he divided into 24 books. In his recension Zenodotus emended the text by introducing new readings, transposing lines, inserting new verses, and branding some passages as spurious or dubious. He also compiled a glossary on Homer's vocabulary and a dictionary of foreign words in Greek. Zenodotus also edited Hesiod's *Theogony* and published studies of Pindar, some of which are still extant. He also may have written some epic poetry. Though some subsequent scholars have regarded his revision as rather subjective, Zenodotus remains a respected pioneer in ancient literary criticism.

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**ZENTA**. See SENTA.

**ZEOLITES**, zē'ō-līts, hydrous aluminum silicates of sodium, potassium, calcium, and barium. Although differing in crystallization and composition, they have certain similar properties, and similar origins. Zeolites are three-dimensional

The alkali and alkaline-earth cations are replaceable. This feature has been made the basis of some household water softeners, in which hard water, containing calcium ions, is passed over a bed of granulated sodium zeolite. A calcium zeolite is formed, and the sodium ions enter the water. These replace the calcium ions and thus make the water "soft."

The zeolites are usually secondary minerals, resulting from the alteration of feldspars and feldspathoid minerals. In a few cases, they seem to be primary, having crystallized from a magma rich in alkalis and low in silica. Zeolites usually occur as fillings in cavities in basalts and other eruptive rocks.

The zeolites are comparatively soft, ranging from 3 to 5.5 in hardness. They are usually white or colorless, but may be colored yellow, brown, or red by impurities. The specific gravities are low, about 2 to 2.5. They are easily decomposed by acids, usually with gelatinization. They intumesce before the blowpipe.

The compositions may be variable, and in some cases are uncertain. Some of the more common zeolites are as follows:

**Analcime**— $\text{NaAlSi}_3\text{O}_8 \cdot \text{H}_2\text{O}$ . Cubic; good crystals common, usually trapezohedrons. Hardness 5 to 5.5. Usually white or pinkish.

**Chabazite**— $(\text{Ca}, \text{Na})_2\text{Al}_2\text{Si}_4\text{O}_{12} \cdot 6\text{H}_2\text{O}$ . Hexagonal; cubelike rhombohedrons. Hardness 4.5. Commonly reddish or white.

**Notrolite**— $\text{Na}_2\text{Al}_2\text{Si}_2\text{O}_{10} \cdot 2\text{H}_2\text{O}$ . Orthorhombic; nearly square prisms. Hardness 5 to 5.5. Usually white.

**Thomsonite**— $\text{NaCa}_2\text{Al}_2\text{Si}_2\text{O}_{10} \cdot 6\text{H}_2\text{O}$ . Orthorhombic; usually in radiating fibers. Hardness 5 to 5.5. Takes a good polish and is used as a semiprecious gem.

**Laumontite**— $\text{CaAl}_2\text{Si}_4\text{O}_{12} \cdot 4\text{H}_2\text{O}$ . Monoclinic. Usually pulverant after exposure.

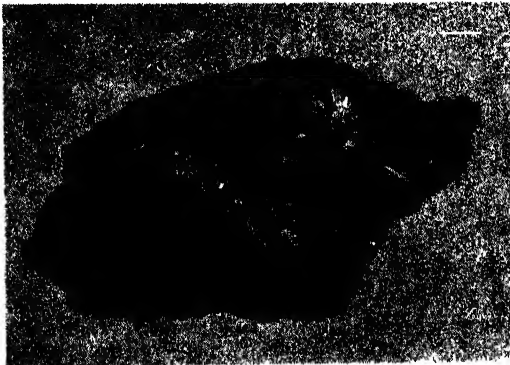
**Heulandite**— $\text{CaAl}_2\text{Si}_4\text{O}_{12} \cdot 6\text{H}_2\text{O}$ . Monoclinic; sometimes large. Conspicuous (010) cleavage. Hardness 3.5 to 4.

**Stilbite**— $\text{CaAl}_2\text{Si}_4\text{O}_{12} \cdot 7\text{H}_2\text{O}$ . Monoclinic; usually in radiating sheaflike groups. Hardness 3.5 to 4.

**Phillipsite**— $\text{KCaAl}_2\text{Si}_4\text{O}_{12} \cdot 6\text{H}_2\text{O}$ ; and **harmotome**— $\text{BaAl}_2\text{Si}_4\text{O}_{12} \cdot 6\text{H}_2\text{O}$ . Monoclinic; cruciform twins common. Hardness 4 to 4.5.

Some of the important localities for zeolites are Great Notch and West Paterson, N.J.; the copper district in the Upper Peninsula of Michigan; Bay of Fundy region, Nova Scotia; Faeroe Islands; the Harz Mountains and the Rhineland, Germany; Cyprus; Bombay and the Western Ghats range, India.

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A radiating group of natrolite crystals.

silicates in which all four oxygen atoms in each  $\text{SiO}_4$  group are shared by adjacent groups. Their structures have an open framework of  $(\text{Si}, \text{Al}) \text{O}_4$ , with the remaining cations and the  $\text{H}_2\text{O}$  in the openings. This structure results in two characteristic behaviors: (1) The water is easily and continuously lost upon heating, and regained by exposure to a moist atmosphere. It may also be replaced by other liquids, such as alcohol. (2)

**ZEPHANIAH**, zēf-əni'ə (in Douay Bible SOPHONIAS), Old Testament prophet: fl. late 7th century B.C. Ascribed to him is the Book of Zephaniah, constituting three chapters of the so-called Book of the Twelve Prophets (or Books of the Minor Prophets) in the Old Testament. Zephaniah's lineage is traced back for four generations to King Hezekiah of Judah (r. about 715–687 B.C.). He was therefore a second cousin once removed of King Josiah (r. 640–609 B.C.), of whom he is believed to have been a contemporary (Zephaniah 1:1) and in whose training, under teachers influenced by 8th century prophets, he may have shared. However that may be, at least he was a citizen of Jerusalem who did not hesitate to criticize royalty while sparing the king himself; he shows less concern for the poorer part of the population; and his teaching fits the conditions of the 7th century immediately prior to the reform of Josiah in 621 B.C., so far as our meager information permits us to know them.

The evils mentioned in 1:4–5, 8–9, and 12 are

similar to those which, according to II Kings 21, were characteristic in Judah until Josiah was moved to action by the finding of the Code of Deuteronomy (621 B.C.). These included star worship, syncretism, foreign clothes and foreign religious practices, apostasy, and the denial of the Lord's activity. Moreover, it is possible that the stimulus to Zephaniah's preaching was given by the Scythian raids which Herodotus (*History*, book 1, chaps. 104-105), who is not always trustworthy, reports were made in this period. In the absence of strictly reliable data, we may tentatively conclude that a prince named Zephaniah delivered an oracle or oracles in the reign of Josiah, presumably about 625 B.C. Not all of the three chapters, however, are his; much of the prophecy probably originated some four centuries later. If the historical problems of Zephaniah could be solved, there would still remain the literary problems.

See also ZEPHANIAH, BOOK OF.

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**ZEPHANIAH, Book of** (in Douay Bible **PROPHCY OF SOPHONIAS**), a book of the Old Testament, attributed in part to Zephaniah (q.v.), a prophet of the late 7th century B.C. In the books of Isaiah, Ezekiel, and the Greek order of Jeremiah, the editors of the prophets show a well-defined pattern: first, denunciation of the people of Judah; then the turning of the divine wrath upon other nations; and finally, promises of prosperity to Judah while the heathen are converted or destroyed. This arrangement appears also in Zephaniah: chapter 1 condemns the sins of Jerusalem; chapter 2 (vss. 4-15) attacks the Philistines, Moabites, Ammonites, Ethiopians (or Egyptians), and Assyrians; chapter 3 (vss. 8-20) describes the gathering in of the exiles, the end of want and trouble, and the presence of the Lord among the remnant of His people. The remaining verses (2:1-3 and 3:1-7) may in part be derived from Zephaniah but contain doubtful features, especially the change from specific, indignant denunciation, which characterizes chapter 1 to the generalities of 2:3 or 3:4-5.

Even in chapter 1, there has been extensive editorial activity. The basis of this chapter is two poems: the first (contained in vss. 4-5, 8-9, and 12) is a declaration of the Lord's punishment of the Jerusalemites for specific sins that were rife in the 7th century B.C.; the second (in vss. 7, 10, 11, the first part of 13, and 14-16) is a description of the day of the Lord, not at the end of time, but near. Here there is no mention of the reasons for the disaster, but only, as in Isaiah 5:26-29 and 10:28-32, a statement of impending doom. When editors combined and interwove these two poems—or perhaps these portions of longer poems now mostly lost—there was ample opportunity for the introduction of quotation (compare the last part of 1:13 with Amos 5:11), for new emphases, and particularly for slight changes that make specific prophecy into vague eschatological predictions of a world catastrophe. Thus verses 2, 3, 17, and most of 18 in chapter 1 show how the day of the Lord close at hand, of which Zephaniah (like Amos before him) had spoken, became the day of universal cataclysm so characteristic of the apocalypses. While the possibility must remain open that one or the other of the two poems was not written by Zephaniah, the most likely hypothesis is that this royal personage delivered two oracles

which fortunately were preserved because of their connection with his name and upon which the rest of the book (in its present form dating perhaps from around 200 B.C.) could develop. The view that Zephaniah himself is "the first of our Old Testament writers whose mind is dominated entirely by eschatological ideas" (William O. E. Oesterley and Theodore H. Robinson, *An Introduction to the Books of the Old Testament*, New York 1934) is no longer generally accepted.

The contribution of Zephaniah is to be sought in his application of the teaching of the 8th century prophets (Amos, Hosea, Isaiah, and Micah)—that the Lord is offended by the conduct of His people—to the conditions of his own time. He was neither highly original nor an exceptional poet. Nevertheless, he has supplied literature with a memorable metaphor, "the men who are thickening upon their lees," and has provided art with the picture of the Lord searching Jerusalem with lamps (1:12; Revised Standard Version). If the teachings of 3:1-4 are his and may be added to those of 1:4-5, 8-9, 12, then his ire is particularly directed toward the oppressive, toward those who compromise with foreign worship and practice—the collaborationists of his day—and toward the indifferent, those who say in their hearts that the Lord does nothing, either helpful or hurtful, in the affairs of men (1:12); "God's causes," says George Adam Smith, "are never destroyed by being blown up, but by being sat upon" (*Book of the Twelve Prophets*, vol. 2, p. 52).

The description of the day of the Lord in 1:7, 10, 11, 13, 14-16 is not without power, and it inspired the *Dies Irae*, the medieval hymn attributed to Thomas of Celano. The Lord is pictured as on the point of offering Judah as a sacrifice, to which the enemy armies are invited as guests (1:7). Special emphasis is laid upon the immediacy of the event—the day of the Lord is at hand (1:7), near and hastening fast (1:14). As in Amos, that day is a day of darkness, not light, a day of distress and anguish, of ruin and devastation, of darkness and gloom, of clouds and thick darkness.

In the section on foreign nations (2:4-15) the religious teaching is not particularly significant; the underlying idea is that the proud will be overthrown and the humble exalted. In chapter 3, however, appears one of the inspiring promises of the eschatologists, the dream of a universal language—a pure speech—so that all nations may be able to worship the Lord together "and serve him with one accord," literally, "with one shoulder" (3:9). And the picture of the humble, truthful, trustful remnant in 3:12-13 inspires successive generations of readers to rejoice at the change of fortune for Israel which the Lord continually accomplishes. Thus even in neglected, obscure, and seemingly unimportant corners of the Old Testament there are treasures of permanent worth.

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**ZEPHYRANTHES**, zĕf'-a-răn'thĕz, the zephyr lily, a genus of some 55 species of bulbous plants of the amaryllis family, Amaryllidaceae, native of the tropical and warm-temperate regions of North and South America. The basal leaves are long and narrow; the solitary, showy flowers, borne on a hollow scape, are 2 to 4 inches long and tubular, with 6 spreading perianth segments which are yellow, white, rose colored, or purplish. Atamasco lily, *Zephyranthes Atamasco*, indigenous to damp woods and meadows of the southeastern United States, has white or purplish flowers. It blooms in spring, is often found in profusion, and is collected and sold commercially. *Z. candida*, a native of South America, occurs in several forms and is frequently cultivated, blooming in late summer and autumn. It has white or rose-tinted flowers.

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**ZEPHYRUS**, zĕf'-a-rĕs, in Greek mythology, god of the west wind, son of Astraeus (Starry Man) and Eos (Dawn), and brother of Boreas (North Wind), Notus (South Wind), and Eurus (East Wind). His wives appear variously as (1) Chloris, goddess of flowers and fruits, by whom he fathered Carpus, god of fruits; (2) Iris, goddess of the rainbow; (3) one of the Hours, goddesses of the seasons; and (4) Podarge, a Harpy, by whom he sired Achilles' swift steeds. Zephyrus, a minor figure in several myths, is usually represented in art as a handsome winged youth, carrying flowers in a fold of his cloak. In Roman mythology Zephyrus becomes Favonius, and Chloris becomes Flora.

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**ZEPPELIN**, zĕp'-a-lĭn, Ger. tsĕp'-a-lĕn', **COUNT Ferdinand von**, German airship builder: b. Constance (Konstanz), Germany, July 8, 1838; d. Charlottenburg, March 8, 1917. The son of a titled Württemberg court official, he attended the Ludwigsburg Military Academy and the University of Tübingen and received an army commission in 1859. In 1863 he went to the United States and served for a time with the Army of the Potomac in the American Civil War. Later he took part in an expedition to the headwaters of the Mississippi. While in Minnesota, he made his first balloon ascent. After his return to Europe, he fought for Württemberg against Prussia in the Seven Weeks' War (1866) and was a cavalry officer in the Franco-Prussian War (1870-1871). He had attained general's rank in the German Army when he was suddenly retired in 1891, at the age of 53. He at once decided to devote his time to the development of dirigible balloons.

Though his costly experiments had soon reduced him to poverty, imperial support and funds raised through public subscription enabled him to build a rigid airship and fly it (for 20 minutes) in 1900. By 1914 several of his dirigibles, called zeppelins, had made flights of more than 1,000 miles, but 13 had crashed. Zeppelins were used to bomb England early in World War I, but they were found vulnerable to both storms and gunfire. The most famous of the zeppelins, the Hindenburg, went down in flames in 1937. By the time of the count's death the greater

potential of the airplane as a means of flight was becoming apparent.

See also AIRSHIP—History.

**ZERAVSHAN RANGE**, ză-ráf-shăn', mountain range, USSR, a part of the Pamir-Alai system of Soviet Central Asia. It is situated in the Tadzhik and Uzbek SSR's, extending east-west along the south bank of the Zeravshan River and rising at some points as high as 18,000 feet. Mineral resources include coal, rare metals, and fluorspar. The mountains are crossed by an automobile road linking Tashkent and Dushanbe.

THEODORE SHABAD.

**ZERAVSHAN RIVER**, river, USSR, a right tributary of the Amu Darya in Soviet Central Asia. It is about 460 miles long, rising in the Zeravshan Glacier, 140 miles southeast of Tashkent, in the Pamir-Alai mountain system. The river flows for some distance in a narrow, deeply entrenched gorge between the Turkestan Range in the north and the Zeravshan Range in the south and passes the town of Pendzhikent. After a course of about 130 miles in the Tadzhik SSR, it enters the Uzbek SSR, where it waters the oases of Samarkand, Katta-Kurgan, and Bukhara before disappearing in the desert sands near the Amu Darya. The Zeravshan collects virtually all of its water in the high mountains of the Tadzhik SSR and supplies it for irrigation in the Uzbek SSR. The oases that depend on it for water are among densely populated and productive in Central Asia. A large storage reservoir near Katta-Kurgan is used for irrigation of the surrounding region. The Zeravshan is not navigable. Its lower course, between Bukhara and Samarkand, is paralleled by a section of the Trans-Caspian Railroad.

THEODORE SHABAD.

**ZERBST**, tsĕrpst, city, Germany, on the Nuthe River, a small tributary of the Elbe, 70 miles southwest of Berlin and 12 miles northwest of Dessau. The old town, once much admired for its stately buildings, was virtually destroyed by aerial bombardment in World War II; only a few towers, remnants of the ancient wall, and parts of the city gates survived. Zerbst is a trading center for cattle and vegetables, especially asparagus; it has several breweries and some manufacturing, including textiles, leather, thermometers, and musical instruments. It existed as early as 1007, when it was mentioned under the name Zirwisti. From 1603 to 1793 it was the capital of the principality of Anhalt-Zerbst. Catherine II the Great of Russia, born a princess of Anhalt-Zerbst, spent her childhood in the city. After World War II it was included in the German Democratic Republic (East Germany), from 1952 in Magdeburg District. Pop. (1981) 19,283.

**ZERMATT**, tsĕr-măt', village, Switzerland, in Valais Canton, Visp District. It is situated at an elevation of over 5,300 feet, 22 miles southwest of Visp, at the foot of the Matterhorn (q.v.), and is the traditional base from which expeditions set out to scale that famous peak. The village is popular both as a summer resort and for winter sports. Pop. (1980) 3,548.

**ZERMELO PARADOX**, tsĕr'mă-lô (also called **BERTRAND RUSSELL PARADOX**), in logic, a problem formulated independently, about 1902-1903, by Ernst Friedrich Ferdinand Zermelo (1871-



1953) and Bertrand Russell (q.v.) It deals with collections (sets) of all sets of objects which are not members of themselves. Suppose that we have a set  $S$ : Is  $S$  a member of itself? In 1919 Bertrand Russell popularized this problem by posing the following paradox: There is a village barber who shaves all those residents of the village who do not shave themselves. Does this barber shave himself? If he does not shave himself, then he should shave himself. But if he shaves himself, then he must not shave himself. Another variant of this paradox is as follows: A man asserts that all persons of his nationality consistently lie. If all persons of his nationality are liars, is the man himself telling the truth or lying? Zernike, a German mathematician, is known mainly for his contributions to the logical theory of the foundations of arithmetic and to set theory (see LOGIC—3. *Modern Deductive Logic*), not the least of these contributions being the paradox which bears his name.

**ZERNIKE**, tsér'nä-kē, **Frits**, Dutch physicist: b. Amsterdam, July 16, 1888; d. March 10, 1966. After showing early promise as a student, he was educated at universities in Amsterdam and Groningen. He joined the staff of Groningen University in 1913 as an assistant in astronomy to Professor J. C. Kapteyn, became professor of theoretical physics and mechanics in 1920, and remained with the university throughout his career.

In the 1920's he developed the Zernike galvanometer, which registers very weak electric currents and is now standard equipment in major laboratories. His spectroscopic studies led to his announcement in 1934 of a "phase contrast" method of detecting and compensating for the irregularities in the curved reflectors of astronomical telescopes. He had already applied the basic principles of this technique to microscopy also, but its practical aspects were not at once perceived, and the Zernike phase contrast microscope came into general use only after World War II.

The phase contrast (or phase) microscope makes it possible to study minute transparent cells of living matter without first staining them chemically. Since such staining usually kills the specimens, the instrument has been of great value in biological and medical investigation, particularly in cancer research. It is equipped with an annular light-controlling diaphragm and a transparent "phase plate" with an annular coating or groove. The plate produces a phase difference of about one-quarter wavelength between the direct and the diffracted light waves that pass through it. This, together with diffraction index variations in the cellular matter under observation, effects an apparent "coloring" of the cells and makes their structures visible as lighter or darker details. Phase contrast microscopy thus is an important forerunner of holography. The Nobel prize for physics for 1953 was awarded to Zernike for his invention of phase contrast. He also developed a "color phase" microscopic process and did important work in chemistry, thermodynamics, and mathematical theory.

**ZERO**, zir'ō; the symbol "0" (or naught), as used in the Arabic system of numerals, and wherever that system is applicable. The standard use of zero is to indicate the absence of some

countable or measurable magnitude whose precise nature is determined by the context. Thus, in the numeral 205, the zero symbol indicates that the intended number is composed of 2 hundreds and 5 units, but no tens; "zero velocity" means no velocity, or rest; "zero degrees Centigrade" means a temperature that is no degrees above the arbitrarily chosen starting point of the thermometric scale, which is a temperature equal to that of melting ice; and "zero degrees absolute" or "absolute zero" (q.v.) refers to the theoretical low point on the absolute temperature scale, that is, a temperature at which it was once assumed there would be no molecular motion whatsoever. As a rule of thumb, "0" or "zero" may be replaced by the adjective "no," in the manner illustrated by the examples given. Like other adjectives, "zero" needs to be attached to a noun or noun clause whose reference it modifies.

The word "zero" is derived from the Arabic *sifr* ("something empty"—compare the related word "cipher"). The use of zero as a visible mark of absence was a striking innovation of the Arabic notation that reached Europe in the 12th century. In Greek and Roman arithmetic, the ambiguity resulting from the absence of a zero symbol was a serious hindrance to scientific progress. Familiar though it is, the use of zero must be reckoned as one of the basic intellectual inventions of modern culture.

An obvious way to indicate absence is by means of a blank space. But such a notation as 2 5, with a mere gap between the 2 and the 5, is easily confused with an error in transcription and fails to indicate what and how much is intended to be omitted; hence the early use of a dot, as in 2.5, to mark the gap. Our present oval sign 0 seems to have evolved from the hexagonal or other closed line originally drawn around the dot as a precaution against ambiguity or forgery. In this way, an auxiliary device for showing mere absence took on the appearance of a substantial symbol, apparently standing for a genuine number on a par with the so-called natural numbers 1, 2, 3, 4, 5, 6, 7, 8, 9.

Considered as a number, zero seems to have odd and mysterious properties that set it apart from the natural numbers. Plausible though it is for the addition of zero to make no difference (on the principle that nothing is being added), the parallel for multiplication by zero has to be rejected. The prohibition of division by zero seems reasonable, but the learner finds it hard to attach clear meaning to the symbol  $x^0$  ( $x$  to the power zero) and is puzzled by the supposed demonstration that the value of  $x^0$  is always 1. The truth is that such symbols as  $x^0$  and 0! (factorial zero) have to be given stipulated definitions that are not derivable from any natural equation of "zero" with "no" or with "nothing."

In modern logic, 0 is sometimes treated as a device for mentioning classes that are null or empty. Thus, to say "There are zero pigs that can fly" is equivalent to saying "The class of pigs that can fly is null," and that in turn means the same as "There are no pigs that can fly." On this conception, 0 does not stand for some peculiar or mysterious entity, though it does have specifiable uses. In practice, however, the mathematician ignores the problem of a logical definition of zero and is content to treat 0 as a symbol sufficiently defined for his purposes by such a familiar rule of use as  $0 + n = n$ .

Although 0 has no reference in isolation, a temptation remains to treat words like "zero," "no," "nothing," and "nobody" as standing for extraordinary entities having a shadowy kind of existence. An ancient example is found in the sect called Neuninians, established by one Radulfus at the end of the 13th century, who worshiped Nemo (that is, Nobody), the supposed person referred to by that name in biblical and classical texts. Similar tendencies may be detected in the preoccupation of some modern existentialists such as Germany's Martin Heidegger with "Nothing" and the alleged "encounter with Nothingness."

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**ZERO-POINT ENERGY**, the kinetic energy remaining in a substance at the temperature of absolute zero; that is, at 0° K or -480° F (see ABSOLUTE ZERO). In many elementary science textbooks it is stated that the absolute zero of temperature would be characterized by complete absence of motion and energy. Although this temperature has not been, and may never be, attained, quantum mechanics, in particular the Schrödinger equation, has shown these statements in regard to the absence of motion and energy to be incorrect. Consider a simple harmonic oscillator, the behavior of which is approximated by a vibrating atom in an isolated molecule or in a solid. The Schrödinger equation gives for the energy of such an oscillator at absolute zero the value  $\frac{1}{2}hf$ , where  $f$  is the frequency of oscillation and  $h$  is Planck's constant ( $6.62 \times 10^{-27}$  erg-seconds). The energy  $\frac{1}{2}hf$  is the zero-point energy, and it cannot be further reduced.

The existence of the zero-point energy has been experimentally confirmed by analyses of molecular spectra and by the thermal behavior of gases at low temperatures. The vibrating atoms in a crystalline solid would have considerable energy in this lowest allowed state of vibration, and the zero-point energy accounts for the strange behavior of liquid helium at temperatures near absolute zero. The concept of zero-point energy satisfies the Heisenberg uncertainty principle, which forbids a particle ever to be completely at rest at a precisely known point.

**ZERUBBABEL**, zə-rüb'ə-bəl, governor of Judaea: fl. late 6th century B.C. The son of Shealtiel, governor of Judah (Haggai 1:1), and a grandson of the captive king Jehoiachin (1 Chronicles 3:17), he was a recognized prince of Judah and led the first band of Israelitish exiles returning from Babylon. He was made governor of Judaea and, with Joshua, the high priest, directed the renewal of public daily worship and the reconstruction of the Temple, which was completed only after a 17-year interruption caused by their enemies.

**ZETA RIVER**, zé'tä, river, Yugoslavia, in the republic of Montenegro. It is a tributary of the Morača (which in turn flows into Lake Scutari), which the Zeta joins near Titograd after a southeasterly course of about 50 miles (80 kilometers) from its double source in the Dinaric Alps. It flows underground for some distance below the city of Nikšić. The last 15 to 20 miles (24 to 32 kilometers) of its course lie in the Bjelopavlići, a broad plain which is one of Montenegro's few fertile lowlands.

**ZETKIN**, tsét'kën, Clara, German Communist leader: b. Wiederau, Saxony, July 5, 1857; d. Arkhangelskoye, near Moscow, USSR, June 20, 1933. Originally a schoolteacher, she joined the German Social Democratic Party and became its outstanding spokesman on women's rights, editing the paper *Die Gleichheit* from 1892 to 1916. She opposed the party's compromising position during World War I and in 1919 joined in forming the Communist Party in Germany. From 1920 to 1933 she was a Communist deputy in the Reichstag, although she had differences during much of this period with the Soviet leadership. She published a number of books on women's problems. Her *Reminiscences of Lenin* appeared in English translation in 1929. She was known as an impassioned orator.

**ZETLAND**. See SHETLAND ISLANDS.

**ZEUGLONON**, zōō'glā-dōn, the popular name of the gigantic fossil whale *Basilosaurus* of the primitive cetacean suborder Archaeoceti. *Basilosaurus* is known from late Eocene deposits in the southeastern United States. Its closest relatives have been found in the late Eocene of Egypt and in the early Oligocene of the Ukraine. *Basilosaurus* and its close allies are the largest archaeocetes, reaching a length of 65 feet. The skull alone may extend 5 feet. The neck is short, but the succeeding vertebrae are elongate. The bones of the rostrum and cranium are not telescoped together as in more-advanced cetaceans. Serrate teeth are present. The anterior limbs were still functional and served as paddles, but the rear limbs are greatly reduced and are contained within the body. Traces of the pelvis and femur have been found. Zeuglodon and the other primitive whales are believed to have originated from primitive terrestrial carnivores.

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American Museum of Natural History

**ZEUS**, zōōs, in ancient Greek religion, the chief deity. He was known to the Romans as Jupiter (Juppiter) and to Asiatic Indians as Dyaus pita. In origin he was an Indo-European divinity—a weather god enthroned on mountain summits, which are watched for indications of weather, and the ruler of the sky (the name means "sky"), where atmospheric phenomena are observed. As god of the bright sky, he controlled the sun, moon, stars, and planets; as god of the dark sky, he caused thunder, lightning, clouds, winds, dew, rain, hail, sleet, snow, comets, meteors, and meteorites.

Zeus was the son of Cronus (Kronos) and Rhea, and brother of Hestia, Demeter, Hera, Hades, and Poseidon. He married successively Metis (Counsel), Themis (Law), and Hera (Lady), of whom the last was his sister. By more than 115 mistresses, both mortal and immortal, he had over 140 offspring, such as the Graces, the Muses, the Seasons, and numerous kings and queens, heroes and heroines, who were considered demideities. His divine children, who ranked as Olympian divinities (except Persephone), were Apollo, Ares, Artemis, Athena, Dionysus, Hebe, Hephaestus, and Hermes.

**Epithets.** Homer, the earliest Greek writer to mention Zeus, calls him "father of gods and men," a designation to be interpreted as signifying a paterfamilias, the father of a family, whose members owe obedience to him as director

of their conduct and upholder of customary law. From this conception came several of his more than 685 recorded epithets, such as *Ktesios* (protector of the household), *Herkios* (defender of the courtyard), *Hikesios* (supporter of suppliants), and *Xenios* (upholder of hospitality). Since the family was the foundation of the state, it was a short step to associate Zeus with care of the city-state; hence political epithets, such as *Polteus* (guardian of the city), *Eleutheros* (vindicator of liberty), *Agoraios* (advocate of the assembly), and *Boulaios* (champion of the council). From his role as overseer of the state developed his role as observer of conditions among mortals; hence moral epithets, such as *Epopsios* (observer of all things), in which capacity he castigated criminals and avenged injured persons, and *Horkios* (maintainer of oaths), in which role he punished those who violated the sanctity of their sworn pacts.

As *Panompaios* (author of all divination), Zeus was the primal source of prophetic power. As *Soter* (savior), he saved persons, particularly sailors and seafarers, from peril. Other epithets referred to the many places where Zeus was worshipped throughout the Hellenic world. Of these the most noted were *Diktaios* (of Mount Dikte in Crete, where he was born); *Lykaios* (of Mount Lykaion in Arcadia, where he was reared); *Olympios* (of Mount Olympus in Thessaly, where he dwelt); *Dodonaios* (of Dodona in Epirus, where his oracle was the oldest oracle in Greece); *Ammon* or *Ammonios* (of Ammonium, now the Oasis of Siwa, in Egypt, where Alexander the Great of Macedon was hailed in 332 B.C. as the son of Zeus Ammon by the priests of this oracular shrine); and *Olympikos* (of Olympia in Elis, where, from 776 B.C., the Olympic games were held quadrennially in his honor and where, in 457 B.C., Phidias completed his colossal statue of *Zeus Olympikos*, one of the Seven Wonders of the World, in the Olympeum or Temple of Zeus).

**Mythology.** Many important myths, with numerous variations, concerned Zeus. Cronus, his father, was destined to be overthrown by one of his sons and therefore customarily swallowed his newborn male children. Rhea, Cronus' sister-wife, consulted Uranus (Heaven) and Gaea or Ge (Earth), their parents, as to how the unborn Zeus might be saved. For her lying-in they sent her to Crete, where she bore Zeus, concealed him in a cave, and substituted a stone, wrapped in swaddling clothes, for Cronus to swallow. The infant Zeus was tended by nymphs and nourished on milk given by a goat and on honey gathered by bees. Weapon-clattering Curetes (semidivine beings) danced around him and by their noise prevented his father from hearing the babe's cries. After he had reached manhood, Zeus plotted with Poseidon and Hades whom Cronus had been persuaded by trickery to disgorge—to dethrone their father. This attempt induced war with the Titans, who supported their brother Cronus. Zeus received aid from the Cyclopes, whom he had liberated from the bonds put upon them by Cronus and who in gratitude armed their deliverer with thunderbolts. He also had the help of certain hundred-handed giants. With these allies he conquered the Titans and then imprisoned them with Cronus in Tartarus (Hell). Thus Zeus won domination of the world, which he then divided by lot with his brothers: Poseidon obtained the sea, Hades received the under-

world, Zeus secured the sky, while the earth was held as common property.

Above all, Zeus was the supreme ruler, the most powerful among the immortals, the protector of regal power, the custodian of law, and the guardian of morality, his assistants being the goddesses Dike (Justice), Themis (Law), and Nemesis (Retribution). According to his own choice, he assigned a good or evil lot to mortals. He was armed with thunder and lightning; the shaking of his shield produced storm and tempest. The eagle, the oak, and the mountain peaks were sacred to him. His sacrifices usually were goats and cattle.

Artists normally portrayed Zeus as a muscular, majestic elder, with abundant locks and bushy beard, wearing a wreath of olive or oak leaves on his head, and holding in his hands various objects, such as a figure of Nike (Victory), a scepter, a cornucopia, and thunderbolts. He is often pictured with an eagle at his feet.

P. R. COLEMAN-NORTON  
Princeton University

**ZEUXIS**, zōōk'sis, Greek painter: b. Heraclea, Lucania, Italy; d. Ephesus, Lydia, Asia Minor; fl. 400 B.C. He either introduced or improved the use of highlights in shading. While he occasionally painted small subjects on clay plaques, his principal work was executed on walls and portrayed human figures in superhuman proportions. The chief criticism of his painting was that it emphasized form rather than character. His greatest fame came from his decoration of the Macedonian royal palace at Pella, where tourists went to admire his art. Like other painters of his period, Zeuxis specialized in mythological subjects, among which are recorded: *Zeus Enthroned amid Deities*; *Eros Crowned with Roses*; *The Centaur Family*; *The Infant Hercules Strangling the Serpents*; *Alcmena*; *Helen*; *Penelope*; *Pan*; *Autoboreas*; *The Muses*; *The Bound Mersyas*; and *The Weeping Menelaus*.

**ZHAO Ziyang**, jou' dzi'yang' (1919– ), Chinese political leader, who became both chief of government and formal head of the Chinese Communist Party (CCP). Zhao was groomed for his job as premier by Deng Xiaoping, China's paramount leader, who had picked him to carry forward the nation's new program of economic modernization. Deng's choice rested on Zhao's record in Sichuan, where he had shown flexibility and innovativeness in converting the troubled economy of that province to one of the most productive in China.

Zhao Ziyang (Chao Tzu-yang) was born in Henan province in 1919. He joined the CCP in 1938, and before the Communist takeover in 1949 he was a county party secretary in Henan. Afterward he rose in the CCP hierarchy of Guangdong, becoming first secretary in 1965. Purged as a "capitalist roader" in 1967 during the Cultural Revolution, he was restored to his Guangdong post in 1972. In 1975 he became party leader in Sichuan, where he experimented with allowing factories greater freedom of management and with increasing the amount of privately cultivated land. By 1978 industrial production was up 81% and farm output 25%. The next year Zhao was elevated to the CCP's central Politburo, and early in 1980 to its Standing Committee, or inner circle. In the role of deputy premier that year, he in effect ran the government

for Premier Hua Guofeng, whom he succeeded in September.

As China's chief administrator, Zhao implemented Deng's policies of loosening state control of the economy, of providing greater incentives for managers, workers, and farmers, and of promoting foreign investment in China. At the same time, he worked closely with Deng's other chief deputy, CCP General Secretary Hu Yaobang, in campaigns against crime and official corruption. The two men were widely regarded as the "legs that Deng stood on." In 1987, Zhao succeeded Hu as general secretary. But in 1989, blamed for "supporting the turmoil" of student-led demonstrations for democracy, Zhao was dismissed from all posts that he held.

**ZHDANOV**, zhda'nôf, a city in the USSR, in Donetsk oblast, Ukrainian SSR, 60 miles (95 km) south of Donetsk. Zhdanov is a major port on the Sea of Azov, near the mouth of the Kalnious River, and the terminus of a railroad from the Donets Basin. The city is an important steel-producing center with three steel mills (the Azovstal, Ilyich, and Kuibyshev plants), using iron ore from Kerch and coking coal from the Donets Basin. Other industries include shipyards, chemicals, and machine building. The port, one of the largest in the Ukraine and in the entire Soviet Union, serves primarily the nearby Donets Basin. In addition to iron ore, incoming goods include manganese, timber, and manufactured and food products; outgoing commodities include coal, steel, machinery, and farm products. Zhdanov has a steel-engineering school and a regional museum. The city was founded by Crimean Greeks in the 1880's and named Mariupol. It had already developed as a port and a steel center before the Bolshevik Revolution, but its growth was speeded under the Soviet regime. In 1948 it was renamed for the Soviet political leader Andrei Aleksandrovich Zhdanov. Population: (1979 census) 503,000.

THEODORE SHABAD

*Author of "Geography of the USSR"*

**ZHITOMIR**, zhi-tô'mër, an oblast in the USSR, in the Ukrainian SSR, on the southern margins of the Pripet Marshes, west of Kiev. More than four fifths of the oblast's area of 11,500 square miles (29,785 sq km) is typical of the marshlands, with gray-brown forest soils, large wooded areas, and much swampiness. Mineral resources are limited to peat, building stone, kaolin, sand, and other construction materials. The economy of the oblast is primarily agricultural, with flax, potatoes, and livestock predominating in the lower-lying marshlands, and sugar beets, wheat, corn, and livestock in the drier uplands. The area's principal cash crops are flax, sugar beets, and hops. In addition to food processing (dairying, meat-packing, sugar refining, alcohol distilling), industries include stonecutting and the manufacture of porcelain, glass, wood, and paper. Furniture and musical instruments are also made. The principal cities are Zhitomir (the capital), Berdichev, Korosten, and Novograd-Volynski. The oblast is inhabited mainly by Ukrainians, Russians, and Belorussians. There was a large Jewish population before the German invasion in World War II. The oblast was formed in 1937. Population: (1979 census) 1,597,000.

THEODORE SHABAD

*Author of "Geography of the USSR"*

**ZHITOMIR**, zhi-tô'mër, a city in the USSR, capital of Zhitomir oblast, Ukrainian SSR, 85 miles (135 km) west of Kiev, on the Teterev River (a tributary of the Dnieper). Zhitomir is an industrial and transportation center of the western Ukraine, situated in a rich agricultural area at the junction of four railroads. Its industries include wood-working plants; manufactures of furniture, musical instruments, and building materials; hosiery and shoe factories; and a large food-processing industry (meat-packing, canned goods). It is also the chief Soviet processor of hops. Zhitomir is a cultural and educational center, with agricultural and teachers colleges and several higher trade schools. The city had a large Jewish population before it was occupied by Germany during World War II.

Zhitomir was founded in the 9th century under Kievan Russia. It was sacked by the Tatars in 1240 and passed to Lithuanian rule in the 15th century. By 1569 it became part of Poland and was annexed by Russia at the time of the second partition of Poland in 1793. In the 19th century it was the administrative capital of Volhynia and an active trading center for timber, grain, and hops. Population: (1979 census) 244,000.

THEODORE SHABAD

*Author of "Geography of the USSR"*

**ZHUKOV**, zhôo'kôf, **Georgi Konstantinovich**, Soviet army officer: b. Kaluga Province, Russia, 1896; d. Moscow, June 18, 1974. The son of peasants, he became a private in the Imperial Russian Army in 1915. By 1917 he had advanced to sergeant and had twice been decorated with the Cross of St. George. After the Russian Revolution, he joined the Red Army (1918) and served throughout the civil war as an officer of cavalry. Zhukov attended the Frunze Military Academy (1928-1931) and thereafter became the commander successively of a cavalry regiment, a division (1934), and a corps (1936). During this period he was closely associated with Gen. (later Marshal) Semyon K. Timoshenko and took a leading part in the development of the Soviet Union's armored forces.

In January 1940, Zhukov was appointed chief of staff of the Soviet forces in the final stages of the Russo-Finnish War. He was promoted to army general in May 1940 and became chief of staff of the Red Army, vice commissar for defense, and an alternate member of the Politburo in January 1941. He was active in the sweeping reorganization and retraining of the Soviet Army that followed the Finnish war.

After Adolf Hitler invaded Russia in June 1941, Zhukov took part in defensive operations on the central and Leningrad fronts as representative of the High Command. In October 1941 he was appointed to command the reserve forces that were being massed for the defense of Moscow, and he brought the German offensive to a halt in December of that year. Meanwhile the Headquarters (Stavka) of the Supreme Command had been organized, and Zhukov became 1st deputy commissar for defense and—under Joseph Stalin's overall direction—the virtual chief of the Soviet war effort, aided by the 2d deputy commissar for defense, Gen. Aleksandr M. Vasilevsky. In 1942 he personally organized the great counteroffensive at Stalingrad and subsequently the operations that resulted in the relief of Leningrad; for these services he was promoted to the rank of marshal of the Soviet Union. His



Marshall Zhukov, a prominent Soviet military leader in World War II, at the Kremlin before a parade.

final front command of the war was the invasion of Germany and the great offensive against Berlin (1944–1945).

After World War II, Zhukov commanded the Soviet occupation forces in Germany (1945–1946) and in 1946 was recalled to Moscow as deputy minister of defense and commander in chief of the ground forces. A few weeks later he was relieved of these posts and ordered to an obscure command at Odessa, apparently because of Stalin's jealousy of his military reputation. Late in 1952, however, Zhukov was suddenly and secretly reinstated in both the posts from which he had been dismissed, for reasons never clearly revealed.

On the death of Stalin, in March 1953, he played a prominent part in the arrest and overthrow of Lavrenti P. Beria, the head of the secret police. The army now became a powerful political force, and in February 1955 army support headed by Zhukov was responsible for Nikita S. Khrushchev's political triumph over Georgi M. Malenkov, Zhukov becoming minister of defense.

In June 1957 the revolt of Vyacheslav M. Molotov and Malenkov against Khrushchev was crushed by Zhukov, who boldly told the Central Committee that the armed forces would not "permit anyone to bid for power." Zhukov was now made a full member of the party Presidium, the first Soviet professional soldier ever to reach the eminence. In October 1957, however, he was ousted from this and all other political positions and again relegated to obscurity, ostensibly for trying to limit the control of the party organization over the armed forces, but probably because Khrushchev had become suspicious of him.

After the ouster of Khrushchev in 1964, Zhukov was allowed to return to public life once again. He made appearances at military functions, and his wartime memoirs, *Toward Berlin*, were published in the official magazine of the Soviet ministry of defense.

GEORGE FIELDING ELIOT  
William Faulkner

**ZIA-UL-HAQ**, zē'oul-hāk', Muhammad (1924–1988), president of Pakistan. A military officer with no apparent political ambitions, he was chief of staff of the army in 1977 when he led a bloodless coup that deposed Prime Minister Zulfikar Ali Bhutto. General Zia then became chief martial-law administrator, and in 1978 he assumed the presidency.

Zia was born in Jullundur, eastern Punjab (now part of India), in 1924. Commissioned from the Royal Indian Military Academy, he moved to Pakistan upon its separation from India in 1947. Holding increasingly important military posts, Zia became a full general in 1976 and was named by Bhutto, over officers with greater seniority, as the army's chief of staff.

When Bhutto's party won an electoral landslide in March 1977, the opposition charged fraud. Widespread unrest brought hundreds of deaths. On July 5, Zia took control by military coup.

Subsequently, Zia failed to hold elections and step down as he had promised. He launched "Islamization" reforms. In 1979, Zia permitted the execution of Bhutto, denying him clemency after the Supreme Court upheld his conviction for complicity in a 1974 political murder. Thereafter, Zia suppressed all opposition.

Zia supported guerrillas fighting against the Soviet puppet regime in Afghanistan. He pressed for withdrawal of Soviet troops, an aim embodied in the U.N.-sponsored accords of early 1988. On August 17, 1988, as Soviet troops were withdrawing, Zia was killed when his plane exploded near Bahawalpur in eastern Pakistan.

**ZIEGFELD**, zig'feld, Florenz (1869–1932), American theatrical producer, who established a standard of taste and artistry that left its mark on stage entertainment. He was born on March 21, 1869, in Chicago, Ill., the son of the founder of the Chicago Musical College. He began his career in the entertainment field by importing bands for the Chicago World's Fair in 1893; he was also manager for the strong man Eugene Sandow. In 1896 he produced the play *A Parlor Match*, with Anna Held, a young actress from Paris, whom he married the next year. She appeared under his direction in shows featuring songs, settings, and costuming, which foreshadowed the musical revues that were Ziegfeld's distinctive contribution to the American stage.

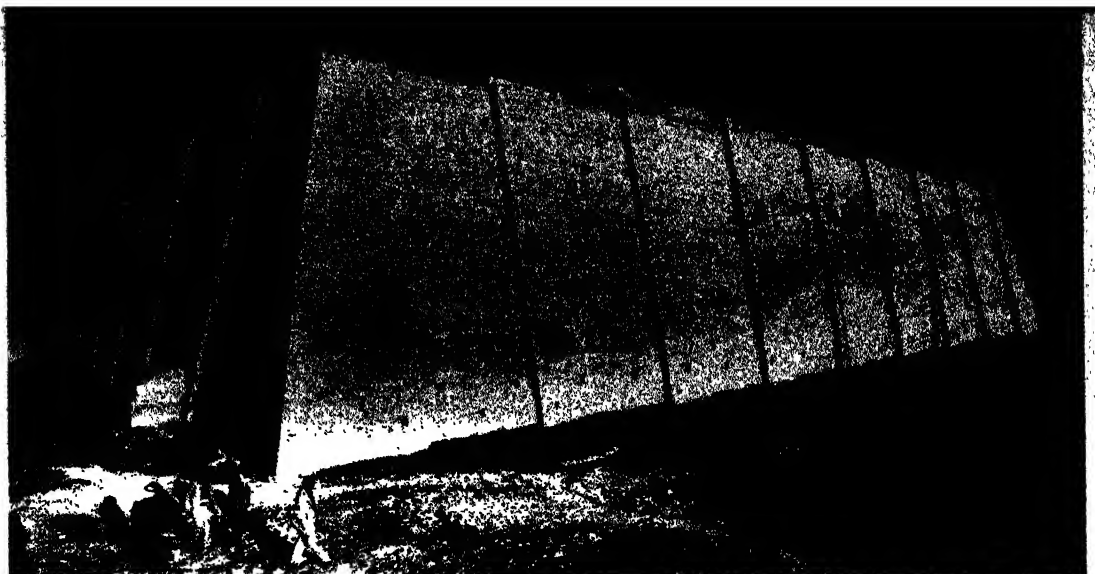
The first of his revues was *The Follies of 1907*, followed by more than 20 consecutive annual editions of *The Ziegfeld Follies*, billed as "An American Institution." They were spectacular displays, combining lavish and imaginative sets and costumes with an abundance of attractive girls. Under the slogan "Glorifying the American Girl," Ziegfeld created a model of feminine beauty that became the fashion, emphasizing slenderness and grace. He hired leading composers, librettists, lyricists, and top-notch comedians for his shows.

Ziegfeld was an acute judge of talent and launched many stars of musical comedy and motion pictures on their careers, including Will Rogers, W. C. Fields, Eddie Cantor, Fanny Brice, Marilyn Miller, and Mae Murray.

Ziegfeld was prodigal with money in his personal and professional life. He sometimes discarded, after one performance, a scene on which he had spent huge sums.

Besides the *Follies*, his outstanding stage successes included *Sally* (1920), starring





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The ziggurat was a Mesopotamian temple tower—either a simple platform (above, at Uruk) or a staged structure.

Marilyn Miller; *Kid Boots* (1923), with Eddie Cantor; *Rio Rita* (1927); *Show Boat* (1927); and *Bitter Sweet* (1929).

Ziegfeld's marriage to Anna Held ended in divorce, and in 1914 he married the actress Billie Burke. He died in Hollywood, Calif., on July 22, 1932.

**ZIEGLER**, tsē'glər, Karl (1898–1973), German chemist, who shared a Nobel Prize for his discoveries of catalysts for synthesizing plastics. Ziegler was born near Kassel, Germany, on Nov. 26, 1898. After receiving a doctorate from the University of Marburg, he taught at the universities of Heidelberg and Halle. In 1943 he accepted the directorship of the Kaiser Wilhelm (now Max Planck) Institute for Coal Research in Mülheim. By this time he was already renowned for his important discoveries in synthetic organic chemistry.

In the early postwar years Ziegler investigated catalytic polymerization reactions. In 1955 he announced the discovery of a variety of metallic and organometallic catalysts that enabled ethylene, propylene, and other olefins to polymerize at low pressures and with hitherto unequalled control over the precise shapes of the macromolecules. On the basis of Ziegler's research, the Italian chemist Giulio Natta developed commercial processes for new high-performance polyethylenes, polypropylenes, and polystyrenes. For the first time it became possible to synthesize a product virtually identical to natural rubber. For this work Ziegler and Natta shared a Nobel Prize in 1963. The new Ziegler-Natta catalysts revolutionized plastics technology, dramatically expanding the applications of these materials while lowering their price. Ziegler died in Mülheim on Aug. 11, 1973.

A. J. ROCKE, *Case Western Reserve University*

**ZIGGURAT**, zig'ə-rat, the temple tower which was the most characteristic feature of sacred architecture in Mesopotamia. In Assyrian the word was *ziqurratu*, from *zaqāru*, "to build high." Its significance is revealed in the Sumerian pictograph for "sanctuary": a house on a mountain.

The ziggurat was an artificial mountain, architectonically conceived and built with immense

communal effort high above the plain to support the sacred shrine destined principally for the descent and visitation of the deity. A monumental stairway led from the summit to a temple at ground level, where the image of the god symbolized his epiphany.

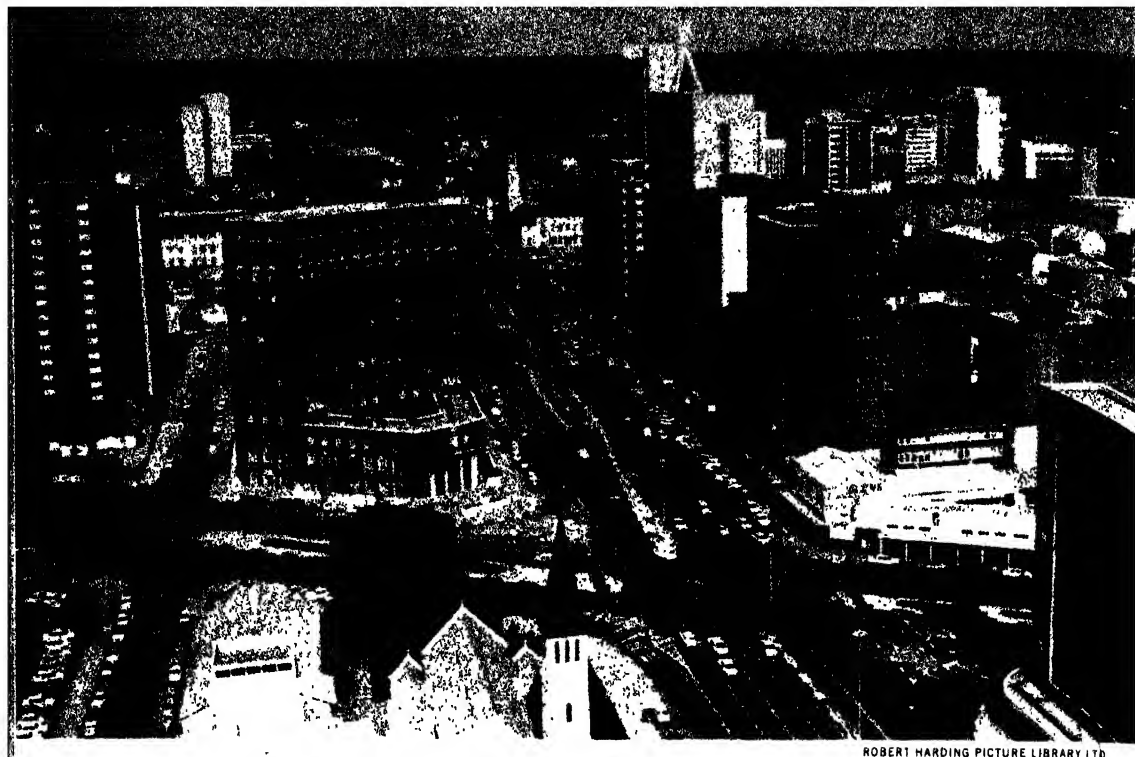
Ruins of more than 30 ziggurats are known from Mesopotamian sites. Every important city possessed at least one temple tower as an integral part of a temple complex dedicated to its principal divinity. The sanctuaries of the 4th and early 3d millennium B.C. were raised on simple platforms: square, as at Erech (Uruk), Brak, and Al 'Ubaid; or oval, as at Khafajah and Uqair. The earliest stepped ziggurats go back to the 3d dynasty of Ur, at the end of the 3d millennium B.C. Examples of these are at Eridu, Ur, Erech, and Nippur.

Two basic types of temple towers evolved: one rectangular, in Sumer (Eridu, Ur, Nippur), featuring a triple stairway; another, square in plan, in Assyria (Kār-Tukulti-Ninurta, Assur or Ashur, Calah or Kalakh). The latter date from the 13th to the 9th centuries B.C.; their means of access are nowhere preserved. The continuous square spiral ramp which led counterclockwise in seven turns to the summit at Khorsabad (ancient Dur Sharrukin, 8th century B.C.) was a new solution. It was copied (6th century B.C.) in the Neo-Babylonian Tower of Babel (Genesis 11:1–9). The Elamite ziggurat at Choga Zanbil (13th century B.C.) is the largest known (320 feet square) and the best preserved.

The huge core of the temple towers consisted of mud brick, often with layers of reed matting between. The masonry was reinforced by anchor chains and was protected by a thick encasement of baked brick laid in asphalt.

The ziggurats rose in three to seven stages, diminishing in area and height. Their walls, articulated by buttresses and sometimes differentiated by colors, believed to be of cosmological significance, sloped inward (Sumer) or were perpendicular (Assyria, Babylon). Plants on the terraces completed the image of the sacred mountain as the source of all life and seat of divine power.

PAUL LAMPL, *Author of "Cities and Planning in the Ancient Near East"*



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Spacious Harare is the capital of Zimbabwe. The city was formerly named Salisbury.

**ZIMBABWE**, zim-bá'hwā, a landlocked republic in southeastern Africa. It is located on the southern African plateau, surrounded by Mozambique, Zambia, Botswana, and South Africa.

Zimbabwe became independent on April 18, 1980, after 14 years of guerrilla warfare waged by black nationalists. As Southern Rhodesia it had been ruled by whites, a minority who originally arrived in 1890 as settlers with Cecil Rhodes' British South Africa Company. Rhodes had intended to extend Britain's African empire from Cape Town to Cairo. Since 1890, Zimbabwe has been successively a territory under company charter, a self-governing British colony, an illegal independent state, a British colony again, and an independent nation under majority rule.

When the white settlers came, they took the best lands and forced the Africans onto overcrowded reserves, now known as communal lands. Africans fought the war of liberation to reclaim what had been theirs. Almost all aspects of the society are undergoing change as the independence government tries to redirect priorities to meet the needs of the African population. Its goals are to develop a nationwide education system and health service, to maintain security, and above all to provide access to land for the majority of the people without jeopardizing the nation's economic well-being.

Soon after independence, several years of drought and world recession strained the country's resources and the government's ability to transform the economic and social structures. But the pace of reform will probably be determined by political pressures, rather than economic considerations, as varying factions within the ruling party vie for dominance.

#### 1. The Land

Zimbabwe extends about 500 miles (800 km) from east to west and 450 miles (720 km) from

north to south. The land rises in the north and northwest from the Zambezi River and in the south from the Limpopo River. In the east a mountainous area known as the Eastern Highlands edges the plateau, separating it from the plains of Mozambique. Here Zimbabwe's highest peak, Inyangani, rises to 8,503 feet (2,592 meters). In the southwest the plateau slopes gently toward Botswana and the edge of the Kalahari desert. Most of Zimbabwe is at least 2,950 feet (900 meters) above sea level. Running nearly 300 miles (480 km) from north to south almost through the middle of the country is the Great Dyke, a range of hills about 6 miles (10 km) wide that contains reserves of chrome ore, platinum, and gold.

The extensive river systems of the plateau drain north into the Zambezi and south into the Sabi-Lundi and Limpopo river basins. The riv-

#### INFORMATION HIGHLIGHTS

**Official Name:** Republic of Zimbabwe.  
**Name of Nationals:** Zimbabweans.  
**Head of State:** President.  
**Head of Government:** Prime Minister.  
**Legislature:** Parliament, consisting of the House of Assembly and the Senate.  
**Area:** 150,803 square miles (390,580 sq km).  
**Boundaries:** North, Zambia; east, Mozambique; south, South Africa; west, Botswana.  
**Elevations:** Highest, Inyangani (8,503 feet, or 2,592 meters); lowest, junction of the Sabi and Lundi rivers (535 feet, or 163 meters).  
**Population:** (1981 provisional census) 7,539,000; (1983 est.) 8,376,000.  
**Capital and Largest City:** Harare.  
**Major Languages:** English (official), Shona, Shindebele.  
**Major Religious Groups:** Animists, Christians.  
**Monetary Unit:** Zimbabwe dollar (= 100 cents).  
**Flag:** Seven horizontal bands of green, gold, red, black, red, gold, and green; at left, a white triangle containing a gold Zimbabwe bird superimposed on a red star. See also FLAG.

ers empty into the Indian Ocean through Mozambique. None of Zimbabwe's rivers are regularly navigable. Along the northwestern border between Zimbabwe and Zambia is Lake Kariba, which covers more than 3,000 square miles (7,770 sq km). The lake was created in 1958-1959 when construction of Kariba Dam flooded part of the Zambezi Valley. "Operation Noah," the rescue of animals stricken by the flooding, received worldwide attention.

Although Zimbabwe lies wholly within the tropics, its high elevations provide moderate temperatures the year round. Moreover, the humidity is low. In summer the temperature averages between 77°F (25°C) and 86°F (30°C); in winter, from 59°F (15°C) to 68°F (20°C). The high plateau is subject to frost.

The rainy season runs from mid-November to the end of March, or late spring to early autumn. Farmers are highly dependent on rainfall, which is often capricious. In almost 30% of the country precipitation is too erratic even for drought-resistant crops. Prime growing areas are in the north central region and the Eastern Highlands, about 19% of the land. About 40% of the country receives more than 28 inches (700 mm) of rain annually, the minimum required for semi-intensive farming. In Matabeleland (the southwest) rainfall is low but sufficient for drought-resistant fodder crops for cattle.

Soils are predominantly sandy, and the land is dotted with granite outcroppings and boulders. The vegetation is savanna grassland on the central (high) plateau, with wooded savanna throughout the rest of the country. Most wildlife is found in the nation's game reserves, primarily at Hwange National Park, Gona Re Zhou Game Reserve, and along the Zambezi River. About 15% of Zimbabwe's territory is set aside as national lands.

In most of the country the high elevation minimizes the risk of contracting malaria, but preventive measures should be taken in the low-lying areas. The tsetse fly, species of which cause sleeping sickness in humans or diseases fatal to cattle, is prevalent in the Zambezi Valley and the extreme southeast.

## 2. The People

Provisional figures from the 1982 census give the population of Zimbabwe as 7,539,000. The average annual rate of natural growth for the 20-year period beginning in 1980 is projected at 4.4%, yielding a population of 16 million by 2000. Only Kenya has a higher growth rate.

**Ethnolinguistic Groups.** Africans constitute almost 99% of the population and speak Bantu languages. Nearly 82% of the Africans are Shona speakers, known as Mashona. Within this grouping are six major linguistic subgroups: the Karanga (22%) from the Masvingo area, the Zezuru (18%) from the Harare area, the Manyika (13%) from the Eastern Highlands, the Korekore (12%) from the Mt. Darwin area, the Rozvi (9%) from the Midlands, the Kalanga (5%) from the far west, and the Ndaue (3%) from south of Mutema.

About 14% of the African population are Shindebele speakers, most of whom are Ndebele, from the southwestern area known as Matabeleland. The remaining 4% are Tonga, Birwa, Venda, Hlengwe, and others.

At the time of independence, the predominantly English-speaking whites numbered about 230,000. Since then, more than 150,000 have



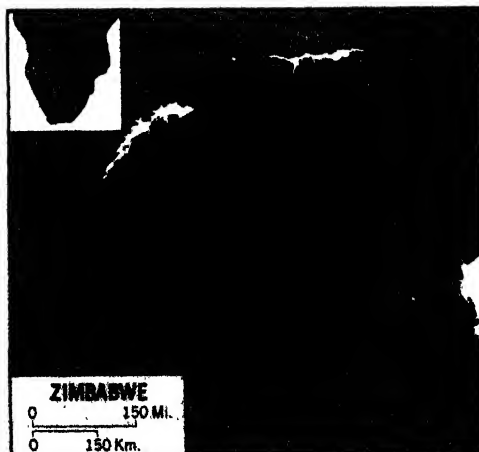
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"The Smoke That Thunders," Masi-aa-Tunya, or Victoria Falls, is Zimbabwe's best-known tourist attraction.

emigrated, reducing the white population to 80,000. The average age of the remaining whites is increasing. The Asian and Coloured (of mixed race) populations are minimal.

English is the official language, but Shona and Shindebele are widely used.

**Religion.** Traditional African belief systems predominate among Zimbabweans. The vast majority of the people practice animism, with a strong emphasis on ancestor worship. Some combine Christian and traditional beliefs. Nearly 25% of the people are Christians. A few are Muslims or Hindus.





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Inyanga National Park lies in the Eastern Highlands near the border between Zimbabwe and Mozambique.

In the past, missionary activity provided rural people with their only opportunity to acquire secondary education. Many of the independence government leaders were educated at Catholic mission schools. The churches continue to speak out against government excesses, much as they did during white rule.

**Urban-Rural Contrasts.** Harare (formerly Salisbury) is the capital. In 1982 it had a population of 656,000, an increase of almost 70% over 1969. Chitungwiza, on the outskirts of Harare, is a sprawling settlement of 172,600. Bulawayo in Matabeleland, is the second-largest city, with a population of 413,800. Cities of 30,000 to 100,000 inhabitants are Gweru (formerly Gwelo), Kwekwe (Que Que), Kadoma (Gatooma), and Masvingo (Fort Victoria) on the plateau; Mutare (Umtali) in the Eastern Highlands; and Hwange (Wankie) in the Zambezi Valley. Between 60% and 70% of Zimbabweans remain in rural areas despite the prolonged drought of the early 1980's, which forced many rural people into urban centers.

The labor practices of the preindependence governments disrupted normal development of both urban and rural areas. Although the majority of the people are rural dwellers, they are overwhelmingly women, children, and old people. Many of the able-bodied men work in the cities as domestic labor or in menial factory jobs; others work in mines or on commercial farms, living at the site of employment. Those who have left dependents behind return to them infrequently but usually provide them with cash and food. Women remain in the rural areas and are responsible for growing food and tending to the young. Many Zimbabweans practice polygamy, and it is not unusual for a man to take a wife in the city and maintain another in his rural household.

**Health.** The government subsidizes a health-care system for those earning less than Z\$150 a

month. In 1980 the country had one nursing person for every 1,190 people and one physician for every 6,580 people. Africans also rely on traditional healers (*n'angas*) for medical advice.

Public and private hospital facilities in the major cities are good. Church missions continue to serve the people in rural areas. Health facilities that were damaged or destroyed during the war have been rehabilitated, largely through foreign-aid programs. But many areas not served by public transportation have no clinic within a day's walk.

The infant mortality rate in 1981 was 72 per 1,000 live births, down from 118 in 1960. Life expectancy at birth is 55 years. The per capita daily calorie supply in 1980 was 1,793, 86% of the minimum requirement.

Poor diets, inadequate sanitary facilities, and lack of clean water sources create health problems for people in rural and poor urban areas. Diarrhea, malaria, measles, pneumonia, malnutrition, and trachoma are the most common diseases and causes of death. The incidence of typhoid is increasing. One half of rural children between the ages of eight and ten have bilharzia, an extremely debilitating infection contracted by swimming or bathing in slow-moving, snail-infested waters.

**Education and Literacy.** One of the government's primary objectives is to provide free primary-level education for all. Almost a sixth of the total annual budget has been spent on education, more than for any other purpose. In 1979 there were about 800,000 primary-school students; in 1983, more than 2 million. The government subsidizes private-school teachers' salaries. Enrollment in secondary schools increased from 73,000 to 300,000 between 1979 and 1983. Schooling is mandatory to the age of 16, and nearly 70% of the adult population is literate.

**Social Change.** Independence freed many young people from the strictures of the extended

family, but as traditional ways undergo change, societal mores are breaking down. For example, the incidence of young women abandoning newborn babies caused such concern among officials that the government endorsed publicly a family-planning program. About 14% of married women use contraceptives. Rural families tend to be large.

Unemployment among the young is a growing problem. The economy is not expanding fast enough to absorb the nearly 90,000 school leavers who enter the job market annually. In addition, thousands of former soldiers, skilled only in guerrilla tactics, must be incorporated into the economy.

The nation as a whole continues to suffer from rivalry between Mashona and Ndebele. As the army of the Mashona-dominated government tries to quell acts of terrorism in Matabeleland, many innocent Ndebele suffer and hostility between the two ethnic groups intensifies.

### 3. Government

The constitution of the Republic of Zimbabwe was drawn up at the Lancaster House Conference in London in 1979. It took effect on independence day, April 18, 1980. The constitution establishes a parliamentary system based on the Westminster model. The legislature is bicameral, consisting of a House of Assembly and a Senate.

The constitution stipulates that for ten years entrenched clauses such as those relating to the composition of Parliament and to dual citizenship may be amended only by unanimous vote of the House of Assembly. Dual citizenship means that a person who became a citizen at independence may retain prior citizenship in another country without being deprived of Zimbabwean nationality.

**Parliament.** The House of Assembly has 100 members, of whom 80 are elected by voters registered on a common roll. According to an entrenched clause of the constitution, the other 20 are chosen by voters on a separate white roll. Elections must be held at least once every five years, or within four months after Parliament is dissolved. House members are elected by their constituents under a system of universal adult suffrage.

The Senate, which has only delaying powers, consists of 40 members, 24 of whom are elected by the House. Another 10 are chiefs (5 Shona, 5 Ndebele) elected from their chiefdoms, and 6 are appointed by the president on the advice of the prime minister.

**The Executive Branch and Civil Service.** The president of the republic is elected for a maximum of two six-year terms by an electoral college composed of members of the House and Senate. His position is largely ceremonial. The Rev. Canaan Banana, an Ndebele, was elected as the country's first president.

The prime minister is head of his party, and he selects the members of his cabinet from either the House or the Senate. Most cabinet officials are former nationalist fighters or strategists. Few technocrats hold high office. In 1980 the Zimbabwe African National Union-Patriotic Front (ZANU-PF) won 57 of the 80 seats on the common roll. The party selected Robert Mugabe as prime minister.

The bureaucracy consists of permanent civil servants, with heads of departments subject to the general direction and control of a cabinet minister. The bureaucratic process is extremely slow. Many skilled, experienced whites have left government service, and their places have been filled by less experienced and less educated blacks. In addition, the bureaucratic ranks

In high-lying Harare many people wear sweaters on a cool day. Cafe umbrellas protect patrons from the sun's glare.

ERWIN & PEGGY BAUER





swelled after independence, absorbing nearly 35,000 job seekers within a few years.

**The Judicial System.** The legal system in Zimbabwe is based on an amalgamation of Roman and Dutch law that was brought originally to South Africa by Dutch trading companies and to Zimbabwe in the 1890's by settlers from South Africa. In 1973 trial by jury, which had been inherited from England, was abolished. In its stead are judges and assessors who determine guilt or innocence.

Six types of law courts exist. The Supreme Court, the final court of appeal, is headed by the chief justice, who is appointed for life by the prime minister. The High Court consists of two courts, an appellate division and a general division, presided over by the chief justice and other judges. Magistrates' courts are located in major urban areas and have civil and criminal jurisdiction over all cases except murder and treason. These courts are conducted by civil servants.

Of the primary courts, community courts are formal courts of record with trained presiding officers and limited criminal jurisdiction. They may interpret customary law. Village courts stem from the old chiefs' or headmen's courts. They may deal with civil cases involving less than Z\$500 and must restrict themselves to interpreting customary law.

**Local Government.** Three main administrative regions encompass the eight provinces. On the provincial level, governors are appointed by the prime minister and report to his office. Provincial administrators, who are civil servants, report to the ministry of local government.

Within the provinces, urban councils are made up of elected officials and administrative

staffs. They raise their own revenue by levying rates on municipal services. Rural councils represent commercial farmers and impose a unit tax on area residents. Urban and rural councils do not employ civil servants. District councils represent communal farmers and rely on administrative grants for their revenue. The district administrator is a civil servant.

The system of local administration established under white rule sorely neglected the small-scale African farmer. The government is endeavoring to compensate for past inequities by creating rural growth points with administrative and social facilities necessary for development.

**Political Parties.** Running parallel to the local government structure is the ZANU-PF party organization. From provincial chairman on down, party officials are actively involved in local affairs, often usurping the functions of government workers. The party is broadly based, encouraging people at all economic levels to join. It has an active youth wing and women's wing. Current government policy is to create a one-party state.

Within the party there are several contending factions, some based on ethnic heritage and others on ideological grounds. Political decisions often reflect the dominance or submission of one group or another.

Opposition parties include the Zimbabwe African People's Union (ZAPU), led by Joshua Nkomo; the United African National Council (UANC), led by Bishop Abel Muzorewa; and the Conservative Alliance (formerly the Republican Front and before that the Rhodesian Front), representing conservative elements of the white community and led by Ian Smith.

Workers load sacks of maize for transport to a bulk-storage site. Maize (white corn) is a dietary staple.

© PETER JORDAN/EPG



Continuation of the emergency-powers regulations left over from the Ian Smith regime of 1965–1979 gives the government extraordinary authority. It may detain people without trial and may bypass Parliament to enact legislation.

The government owns the major media outlets: television, radio, and leading urban newspapers. Political parties must apply to the government for permission to hold rallies.

#### 4. The Economy

Zimbabwe is predominantly agriculture but has rich mineral resources and a highly developed infrastructure. Its wealth is controlled mainly by whites, both individual and corporate. Extractive and manufacturing industries generally are owned by foreign investors, usually British or South African.

The postindependence government of Prime Minister Robert Mugabe seeks to create a socialist state and thereby redistribute the wealth. However, it has moved cautiously in this direction, recognizing that it needs a strong economic base to work from.

**Agriculture.** White commercial farmers continue to own the prime farming land. Some blacks own freeholds, but most hold land in communal areas in the poorer, overcrowded regions. Most Africans are subsistence farmers. The government buys land from white farmers on a willing-seller, willing-buyer basis in order to resettle Africans. About 12,000 African families are resettled annually.

Tobacco and cotton are major export crops. With good rains, commercial and communal farmers grow enough maize (white corn) to feed the country, with a surplus for export. Winter wheat for domestic use is grown by commercial farmers on irrigated fields.

The size of cattle herds decreased substantially during the war and the drought. Efforts are under way to restore the herds, because beef will become an important export if the European Economic Community agrees to accept Zimbabwe beef. Tea, coffee, and sugar are also grown for export.

**Forestry.** Only three types of indigenous trees—mukwa, Zimbabwe teak, and Zimbabwe mahogany—are used in commercial operations. They are harvested from a 2-million-acre (800,000-hectare) woodland in Matabeleland for use in making furniture. Exotic trees like eucalyptus or *Saligna* gum are used for power-transmission poles and fence posts. Pine plantations feed the paper pulp industry.

Throughout the country deforestation is a major problem. Most of the people depend on wood for cooking, fuel, light, and heat. Because felled trees have not been replaced, soil erosion and river siltation have resulted.

**Mining and Manufacturing.** The mining industry suffered heavy losses and closures as a result of the world recession in the early 1980's. The government attempted to subsidize mines but found it too costly. Thousands of mine workers lost their jobs.

Gold is the most important of some 40 minerals mined in Zimbabwe. Most gold-mining operations are owned and operated as small workings. In 1983 the value of gold output reached a record \$194 million, more than the combined value of the next five most important minerals— asbestos, nickel, coal, copper, and chrome ore. The country has vast reserves of coal.



MONKMEYER PRESS

A mine worker carefully removes crystals of mica from surrounding rock. Zimbabwe produces over 40 minerals.

The well-developed manufacturing sector accounts for a fourth of the gross domestic product, the highest proportion in black Africa. Highly diversified, it supplies most of the country's needs for durable and nondurable goods and is an important earner of foreign exchange. Continued high performance depends on the availability of foreign exchange, replacement of managerial and technical skills lost through emigration, maintenance of the domestic consumer market, and replacement of obsolescent machinery.

Manufacturing is concentrated in and between the Harare and Bulawayo areas. During the period of steady growth between 1964 and 1974, intermediate and capital goods industries led the way as international trade sanctions encouraged import substitution. Production of metals and machinery nearly equals that of food processing in value. Two other major industries are textiles and clothing followed by chemicals, including fertilizers, pesticides, soap preparations, pharmaceuticals, and plastics.

The Hwange thermal power station is the largest consumer of coal. Electricity is generated from Hwange and from the Kariba Dam on the Zambezi.

**Foreign Trade.** Zimbabwe's major trading partners are South Africa followed by Britain, the United States, and West Germany. With the lifting of international trade sanctions that were imposed against the illegal government in 1965 to 1979, exports increased by more than 40% in four years. But in the same period imports rose by more than 65%.

Zimbabwe's major exports are cash crops—tobacco, cotton, sugar—and minerals—asbestos, nickel, gold, and ferroalloys. Its major imports are machinery, transportation equipment, spare parts, chemical products, and petroleum. The country runs a trade deficit of about \$500 million annually.

**Transportation.** The road network in Zimbabwe is extensive and well maintained. All



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A farmhand loads tobacco onto a truck. Tobacco has long been one of Zimbabwe's leading commercial crops.

major roads and most secondary roads are paved. Tertiary roads are dirt but well graded.

Railroads link Zimbabwe with the Mozambican ports of Beira and Maputo and with South African ports. Other lines connect with Botswana and Zambia. The railroads are partially electrified.

The national airline is Air Zimbabwe. Most international flights use Harare International airport.

**Tourism.** Zimbabwe's tourist facilities were developed before the war, but the tourist trade did not revive afterward. The number of South African visitors declined, and European visitors remain uneasy about security. Several tourist hotels have closed.

The major attraction is Victoria Falls—or Mosi-Oa-Tunya, "the smoke that thunders"—on the upper Zambezi. Lake Kariba has fine facilities for tourists and anglers. Game reserves for viewing and hunting also draw visitors from Europe and the United States.

## 5. History

Late Stone Age Bushmanoids, who were hunters and gatherers, freely roamed the Zimbabwean plateau before about 1000 A.D. By then, Early Iron Age Bantu-speaking Negroids, migrating from the north, had absorbed the Bushmanoids or pushed them into the Kalahari desert.

The Bantu were agricultural and pastoral peoples who settled along the watercourses of the plateau. There they found a good climate, free of tsetse fly, and developed surface mining of gold, iron, and copper.

After 1000, Late Iron Age Bantu arrived and absorbed the earlier peoples. They brought with them improved mining techniques and an emphasis on cattle rather than goats and sheep. Eventually, they traded gold and ivory for ceramics, cloth, and beads brought by Muslims from the Indian Ocean coast.

**Early States and Empires.** By the 11th century the Karanga, a group of Late Iron Age Bantu, had

developed the southern plateau area and had formed the Zimbabwe state. Some grew wealthy from trade and mining, and they constructed elaborate walled settlements. Over time, craftsmen improved and refined stone-building techniques. Their efforts culminated in the construction of the Imbahuru (Great House) at Great Zimbabwe, near present-day Masvingo, during the 1300's and 1400's. Smaller structures in the same style of exfoliated granite were built in other areas where people spoke similar languages. At Great Zimbabwe, limited resources and overpopulation forced the occupants gradually to abandon their site by 1500. See also ZIMBABWE (ruins).

As people moved out of the Zimbabwe state, some went westward and established the Torwa state at Khami, near present Bulawayo. Others moved northward to the edge of the plateau. One such group traveled under a leader named Mutota to just above the Zambezi escarpment. The new state founded there was called Mutapa, and by the mid-1400's its influence had spread as far as the Indian Ocean coast in Mozambique.

After the Portuguese established themselves on the Mozambique coast in the early 1500's, they pushed into the interior along the Zambezi River, following the trade routes. The upheavals caused by the Portuguese wars with the local peoples forced groups to flee southward. Among them were the Rozvi. Because the Torwa state in the southern region was weak and splitting up, the Rozvi moved into that area. By the 1600's they had established themselves as masters of Torwa and called their new dynasty Changamire. They expelled the Portuguese from the plateau and ruled in the southwest until the Ndebele invaded the area and defeated them.

The Ndebele were Nguni peoples fleeing the havoc caused by Shaka's Zulus in the eastern region of present-day South Africa. In the 1840's, under Mzilikazi, the Ndebele destroyed the Changamire state: they raided Rozvi settlements for cattle and women, incorporated many of the people into their own state, and established their capital at Bulawayo ("the place of slaughter").

The Ndebele are believed to have first used the word "Shona," as a derogatory term for the people they had defeated. When the British arrived they extended the term to all the peoples native to the plateau.

**Charter Company Territory.** Other than scattered missionary groups, the first contingent of British arrived in 1890 carrying the flag of Cecil John Rhodes' British South Africa Company, (BSAC). They came in search of gold. Previously, a huge vein of gold-bearing rock had been discovered in the Witswatersrand of the Transvaal in South Africa. Believing that the vein extended northward and also remembering tales of the Queen of Sheba and the land of Ophir, the BSAC (chartered by the British crown in 1889) sent out the Pioneer Column of young men in search of gold. On Sept. 12, 1890, the Column raised the company flag on Harare Hill, where they proceeded to establish Fort Salisbury.

In 1888, Rhodes had sent his envoy Charles Rudd to make an agreement with Lobengula, the son of Mzilikazi and king of the Ndebele. In the Rudd Concession, Lobengula unwittingly gave the BSAC extensive mining rights. By 1893 the company realized that there was little gold in the norther plateau and moved south toward Matabele-



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Country women display their hand-crocheted work, a source of extra income for their families.

land. A local disagreement between Shona and Ndebele served as an excuse for the BSAC to launch a full-scale attack against the Ndebele. The company destroyed Lobengula's kingdom and took over the prime lands.

With the defeat of the Ndebele, the Europeans began conscripting Africans to work the mines. In 1896 the Ndebele revolted against the conditions imposed on them. The Mashona in the northern areas also had been deprived of their lands, and as word of fighting spread they joined the Ndebele in battle against the Europeans. Although the uprising was soon put down by superior European firepower, this early resistance to outside rule is celebrated by Africans as the first "Chimurenga," or war of liberation.

The mines returned little gold. In order for the BSAC to recoup its expenses, it encouraged European farmers to settle and allocated the best lands to them. By 1901 there were 11,000 white settlers.

Although the British government was unwilling to assume any financial stake in the new territory of Southern Rhodesia, it did insist that the company give white settlers some legislative control. In 1907 settlers were assigned a majority of the seats in the legislature, and in 1914 they were allowed to assume the company's powers when its charter expired in 1923.

**British Colony and Illegal State.** In the 1922 referendum on the future status of the territory, the settlers voted to become a self-governing colony rather than be incorporated into South Africa. In 1923 a constitution was drawn up for the colony of Southern Rhodesia, giving Britain the right of veto on discriminatory and constitutional matters.

In 1930 the legislature passed the Land Apportionment Act, which divided the land between blacks and whites without regard to population numbers. Africans received the poorest and most inaccessible land. In addition, Africans were forbidden to compete with whites in growing cash crops such as tobacco. The 1934

Industrial Conciliation Act further restricted African competition in the work force. It ensured the availability of large numbers of Africans as cheap migrant labor.

The years between the two world wars were a time of enormous economic growth in the colony. Under Prime Minister Godfrey Huggins (1934 to 1953) the iron-and-steel industry was developed, the textile industry was established, and tobacco became a major export crop. Between 1938 and 1958, the economy grew at an annual rate averaging 9%. The colony attracted many white immigrants after World War II, especially from the United Kingdom. Between 1945 and 1958 the white population increased from 80,000 to 205,000.

In 1953, Huggins became prime minister of the newly formed Federation of Rhodesia and Nyasaland. The federation lasted until 1963, by which time measures had been taken to bring about majority rule in Nyasaland (Malawi) and Northern Rhodesia (Zambia).

Many factors had contributed to the growing spirit of nationalism on the African continent. Returning soldiers had fueled the impatience of the people to have full rights as citizens. Britain was unable to hold its colonies by force and unwilling to sustain the financial costs of them. And, at least in Southern Rhodesia, local conditions for blacks had worsened.

Anger over application of the 1951 Land Husbandry Act in 1955, by which semi-individual land ownership by Africans was shifted to communal ownership, led to the formation of the African National Congress (ANC) in 1957. The ANC was banned in 1959 but was replaced by the National Democratic party (NDP) in 1960.

As prime ministers of Southern Rhodesia, Godfrey Huggins and his successor Garfield Todd had inaugurated measures to end the segregationist policies adopted by the colony and to develop an educated black middle class. Todd proved too liberal for his own party and was replaced by Edgar Whitehead in 1958.



UPI-BETTMANN

Prime Minister Robert Mugabe was a leader of the Patriotic Front's struggle for the liberation of Zimbabwe.

Whitehead tried to maintain white support for his government while he defused nationalist stirrings. Believing that he had enough support from the black community to convince Britain that the colony should be granted independence, he invited the NDP to attend talks on a new constitution. The NDP rejected the terms of the proposed charter, which called for eventual, but far-off, majority rule. However, the white electorate endorsed the new constitution in a 1961 referendum.

Whitehead was unable to walk the line between black and white aspirations. In the 1962 elections, he frightened whites when he called for repeal of the Land Apportionment Act. Whites opposed to reform organized the Rhodesian Front (RF) and won the election overwhelmingly. Winston Field, the RF's first prime minister, was replaced in 1964 by Ian Smith.

Smith consolidated white political power, detained and imprisoned black opposition leaders, and discontinued negotiations with Britain on independence for the colony. On Nov. 11, 1965, he issued a unilateral declaration of independence (UDI), proclaiming the colony an independent nation.

Britain ruled out the use of force against the rebel government of "Rhodesia" and applied economic sanctions instead. The United Nations imposed mandatory sanctions that were adhered to by some members and circumvented altogether by others. Rhodesia freely traded with South Africa and with Portugal and its colonies. Sanctions had the unexpected side effect of strengthening import-substitution industries in Rhodesia.

**The Nationalist Movement.** During Smith's 14-year rule, many of the nationalist leaders were in detention or in exile. Moreover, dissension existed within and among the nationalistic groups. In 1963 the outlawed Zimbabwe African People's Union (ZAPU, successor of the NDP) split apart, mainly because of disagreement over decisions made by its leader, Joshua Nkomo. A new party was formed, the Zimbabwe African National Union (ZANU), led by the Rev. Ndabaningi Sithole. It too was soon banned, and in 1971 a

new internal party was formed, the African National Council, headed by Bishop Abel Muzorewa.

Guerrilla warfare began in the 1960's, but the nationalistic forces at that time were poorly trained and ill equipped. The 1966 "Battle of Sinoia (now Chinhoyi)" symbolically marks the beginning of the second "Chimurenga," although intensive fighting did not get under way until December 1972, in the northeast.

Events in Portugal had immediate effects on the future of Rhodesia. In 1975, a year after the military had taken control in Lisbon, the Portuguese government freed Angola and Mozambique from colonial status. The government that took power in Mozambique was sympathetic to the nationalist cause in adjacent Rhodesia, especially to ZANU freedom fighters.

With the end of Portuguese rule in Mozambique and an increase in military supplies to the guerrillas from the Soviet Union and China, South Africa and the United States put pressure on Ian Smith to come to terms with the nationalists. At the 1976 peace conference in Geneva, Smith accepted proposals that would lead to majority rule within two years. But agreement could not be reached on the form of an interim government, and the talks collapsed. In anticipation of the conference, Nkomo and Robert Mugabe, the new leader of ZANU, had formed the Patriotic Front (PF) to present a united nationalist stand.

With the collapse of the talks, fighting intensified, bringing greater hardships to the African people, an increase in military spending, and attacks on refugee camps in Mozambique and Zambia by the Rhodesian military. As costs escalated, Smith attempted to forge an alliance with three internal national leaders: Muzorewa, whose party had been renamed the United African National Council (UANC); Sithole, head of a ZANU splinter group (ZANU-S); and Chief Jeremiah Chirau, leader of the Zimbabwe United People's Organization (ZUPO). They agreed on a new constitution and in April 1979 held elections based on universal adult suffrage. The Patriotic Front did not participate.

The UANC won the election, and Bishop Muzorewa became prime minister of the newly named Zimbabwe Rhodesia. However, his government was unable to end the fighting, even though its army was increasingly well supplied. Also, the new government was denied international recognition and the lifting of sanctions, because the internal settlement did not have the support of the majority of the Africans. The Patriotic Front was the only organization internationally recognized as representative of the African population.

The "front-line states"—Botswana, Mozambique, Zambia, and Tanzania—persuaded Britain to try to work out an agreement for an internationally acceptable independent Zimbabwe. In response Britain hosted a 14-week conference at Lancaster House, London, beginning in September 1979. Mugabe and Nkomo attended as the Patriotic Front, and a constitution acceptable to all parties was agreed on.

Until supervised elections could be held, Zimbabwe Rhodesia reverted to colonial status as Rhodesia. Elections held in February 1980 were contested by ZANU as ZANU-Patriotic Front (Mugabe), ZAPU (Nkomo) as Patriotic Front-ZAPU, the UANC (Muzorewa), and sever-



al smaller parties. ZANU-PF won 71% of the vote.

**The Republic of Zimbabwe.** In April 1980, on becoming prime minister of the Republic of Zimbabwe, Robert Mugabe faced a society divided by years of fighting. The government successfully integrated the forces of the three warring factions: the Rhodesian army and the guerrilla fighters of the ZANU and ZAPU armies. Today these groups form the national army.

Reconciliation between whites and blacks was achieved remarkably quickly. After an initial exodus of whites, nearly 200,000 remained. But economic conditions, declining quality of education, and various decisions taken by the government prompted many more whites to leave. As they departed, they deprived the country of sorely needed skills. Consequently, technological aspects of the infrastructure, such as the telephone system, deteriorated.

Mugabe introduced a rather vaguely defined ideology of "scientific socialism." Opposition within ZANU-PF continued over the pace and direction of change. Tensions between the predominantly Mashona ZANU-PF and the Ndebele-based ZAPU were exacerbated by terrorist activities in Matabeleland and army reprisals; by the detention of two ZAPU leaders even after the Supreme Court had acquitted them of charges; and by Mugabe's insistence on creating a one-party state, thus eliminating all opposition to ZANU-PF.

Aid from the international community cushioned economic problems in the early years of independence, giving the government sorely needed foreign exchange. International assistance also made possible government purchase of land in order to resettle people from overcrowded communal areas. The government's promises, though, far exceeded its ability to fulfill them as economic growth declined and inflation increased. Reduced foreign-currency allocations to importers hampered the manufacturing industry. And emergency economic measures introduced to slow the outflow of foreign currency further discouraged foreign investors.

Zimbabwe is a nonaligned nation. It re-

ceives aid from Eastern and Western nations, and the United States is its major donor. South Africa is its major trading partner; the two countries maintain trade missions in each other's capital although they do not have diplomatic relations. Zimbabwe has been instrumental in developing and strengthening the Southern African Development Coordinating Committee (SADCC), intended to bring about regional cooperation and eventual loosening of ties with South Africa.

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**ZIMBABWE**, zim-bā'bwā, spectacular stone ruins in southern Zimbabwe, 17 miles (27 km) southeast of Masvingo. The name Zimbabwe is of uncertain etymology but possibly means "houses of stone." The Republic of Zimbabwe is named for the ruins, which are also known as Great Zimbabwe.

The size of the ruins and their relatively good preservation (partly restored) distinguish them from many others in the southern half of the country and adjacent territories. With few exceptions, the building stone of all these structures is a local granite that has weathered into flat-sided slabs.

**Buildings.** The Elliptical Building at Zimbabwe consists of a great oval circuit wall about 280 yards (256 meters) in circumference and 30

The massive stone ruins seen at Zimbabwe today were built of local granite over a long period beginning in the mid-15th century, but the site was inhabited as early as the 4th century.

TORY CARR—ALAN BOND ASSOCIATES



feet (9 meters) high (the top is dilapidated). The granite bricks are laid in fairly regular courses without through ties. Three fine entrances break the continuity and display the peculiar rounding of entrance ways and integrated steps unparalleled outside ruins in the republic, where curvature of plan is a general feature.

Within this great enclosure, notable features include a second wall, 100 yards (91 meters) long, parallel with and only 3 to 4 feet (0.9–1.2 meters) from the taller circuit wall, forming a long, forbidding passage. It widens into a semi-enclosed area, popularly called the Sacred Enclosure. Here stands the Conical Tower, a 30-foot (9-meter) tapering cone of solid masonry, with a basal diameter of 18 feet (5.5 meters). Excavations made underneath it in 1929 failed to reveal its purpose.

The Zimbabwe Acropolis is a wall-strengthened kopje (steep hill), some 300 feet (90 meters) above the Elliptical Building. Steep stone-stepped ascents lead up to and through crevices in the rock precipices, upon the crests of which are parapet walls of immense strength, edging level enclosures. As in the Elliptical Building, and elsewhere, these walled enclosures were originally filled with clay or *daga* floors and huts. Their frequent reconstruction caused constantly rising levels of debris, eventually up to 18 feet (5.5 meters) thick, making it necessary to raise the retaining walling.

**Age and Origin.** The age and origin of Zimbabwe have been debated since it was discovered in 1868. Historical assessment by archaeological methods has been cramped by the depredations of early English gold hunters, stimulated by widespread evidence of ancient gold mining, reported by Arab chroniclers in the 11th century A. D. The earlier view that the buildings were erected by Oriental prospectors, at periods variously placed from 2000 or 1000 B. C. down to the Christian era, was challenged by later scientific excavators, who unanimously affirmed that the structures were of native origin and of medieval and postmedieval age.

Between 1946 and 1962, carefully planned, unhurried archaeology was carried out on ruins in the country. This culminated in 1958 in excavations on the Acropolis and in the Elliptical Building at Zimbabwe. The results disclosed a far more integrated, though complex, history than anything possible before radiocarbon determinations replaced the former deductions based on datable imports. They indicated a prolonged occupation of the site beginning before the 4th century A. D. by people already using iron and living in pole-and-*daga* huts, but without stone walling. These people, contemporary but not identical with the earliest gold miners, were replaced in the 11th century by newcomers responsible for the earliest examples of granite walling. Not until about 1450 were the great stone monuments, as now known, begun in prolonged stages. Throughout this history the inhabitants are believed to have been indigenous, although tribally changing, Africans.

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Author of

*"Zimbabwe Culture: Ruins and Reactions"*

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**ZIMBALIST**, zim'bə-list, Efrem (1889–1985), Russian-American violinist. He was born in Rostov-on-Don, Russia, on April 9, 1889. After studies with his father and with Leopold Auer at the St. Petersburg Conservatory, he made a sensationally successful appearance as a violinist at Berlin in 1907, and thereafter embarked on a brilliant European career as a virtuoso. On Oct. 27, 1911, he made his United States debut with the Boston Symphony Orchestra, playing the solo part in the first American performance of Aleksandr Glazunov's Violin Concerto. After a long series of international tours, including six visits to the Orient, he served as head of the violin department from 1928 to 1941 and as director from 1941 to 1968 of the Curtis Institute of Music, Philadelphia. The institute had been founded in 1924 by Mary Curtis Bok, whom he married in 1943. His first wife was the noted soprano Alma Gluck, who died in 1938. Zimbalist also was a composer and wrote the opera *Landara*. He died in Reno, Nev., on Feb. 22, 1985.

EFREM ZIMBALIST, JR. (1923– ), the son of Efrem Zimbalist and Alma Gluck, was an actor, chiefly in films and on television. He starred in the TV series *The FBI* (1965–1973) and in the films *By Love Possessed* (1961), *The Chapman Report* (1962), and *Airport 1975* (1974).

HERBERT WEINSTOCK\*

Coauthor of *"Men of Music"*

**ZIMMERMANN**, tsim'ər-män, Arthur, German statesman: b. Marggrabowa, East Prussia, Oct. 5, 1864; d. Berlin, June 6, 1940. He was counselor in the foreign office from 1908, undersecretary for foreign affairs from 1911 to 1916, and secretary of state for foreign affairs from November 1916 to August 1917. On Jan. 19, 1917, he sent a telegram to the German minister in Mexico, informing him that the German government had decided to open unlimited submarine war on February 1. The minister was told that he should propose to the Mexican president the conclusion of a German-Mexican alliance if, as the Germans expected, the United States gave up its neutrality as a consequence of the unrestricted submarine campaign. Mexico was to be urged to reconquer its "lost territory" in Texas, New Mexico, and Arizona, and to endeavor to win the cooperation of Japan against the United States.

Since the German government had complained that it could not freely communicate with its foreign missions concerning President Woodrow Wilson's proposal of December 1916 to mediate among the warring powers, the United States Department of State had agreed to send such German messages over its own lines. The coded Zimmermann dispatch consequently was cabled by the American embassy in Berlin to the Department of State in Washington and delivered to the German ambassador, who transmitted it to Mexico City. The British intercepted and deciphered it, however, and presented the full text of what became known as the "Zimmermann note" to the United States government after Germany's announcement of unlimited submarine warfare. The note was published in the United States on March 1, 1917. It aroused strong anti-German feeling there and was an important factor in prompting the American declaration of war on Germany on April 6.

HAJO HOLBORN, Author of  
*"A History of Modern Germany"*

**ZINC**, a shiny white metallic chemical element with a bluish gray luster. In the metal trades zinc often is known as spelter, especially when in the form of ingots, plates, or slabs. It is one of the four most important metals from the standpoint of quantity produced, being exceeded only by steel, aluminum, and copper, in that order. Zinc is widely used as a protective coating on steel products, as the major ingredient in die-casting alloys, and as an ingredient (together with copper) of brass. It is also an important ingredient in the manufacture of rubber and paints.

**History.** Accurate knowledge of zinc has been acquired only in the last 200 years. This is because zinc is one of the more active elements chemically, and as a result its ores as found in nature are rather difficult to convert to the metal.

Zinc was in use as a constituent of brass by the Romans and certain civilizations of the Middle and Far East more than 2,000 years ago, but the fact that it was a distinct metal was not recognized until much later. Philippus Aureolus Paracelsus invented the name "zinck" for a substance produced in lead-silver smelting furnaces, but he regarded it as a "bastard of copper." In 1721 the German Johann Friedrich Henckel isolated zinc, and that date must be considered as marking the discovery of zinc by the Western world. It is true, however, that elementary zinc was being made in China and perhaps in India more than 300 years earlier, some of it apparently finding its way to Europe as early as the 17th century. Undoubtedly some knowledge of the Oriental procedure had reached England, and in 1740, William Champion began smelting zinc at Bristol. It was not until 1807, however, that the first successful operation was set up on the continent of Europe, at Liège, Belgium.

Zinc was first produced in the United States in 1835 at the Washington, D. C., arsenal from New Jersey ores. Between 1850 and 1860 various experiments aimed at smelting zinc were made, but it was not until 1860 that commercial success was attained at La Salle, Ill., and South Bethlehem, Pa.

**Properties.** The chemical symbol for zinc is Zn. Zinc belongs to group II of the periodic table of elements. Its atomic number is 30, and its atomic weight is 46.37. The metal has a density of 7.133 and a hardness low to intermediate among metals. It melts at  $419.5^{\circ}\text{C}$  ( $787^{\circ}\text{F}$ ) and boils at  $906^{\circ}\text{C} \pm 1^{\circ}\text{C}$  ( $1663^{\circ}\text{F}$ ). Zinc is very ductile in the temperature range of  $100^{\circ}$  to  $150^{\circ}\text{C}$  ( $212^{\circ}$ – $302^{\circ}\text{F}$ ), but at  $200^{\circ}\text{C}$  ( $392^{\circ}\text{F}$ ) it is brittle. Metal of high purity is ductile even at room temperature, but ductility decreases with increased content of impurities.

Zinc's outstanding chemical property is its decidedly active or electropositive character, only aluminum and magnesium, of the more common metals, exceeding it in this respect. This characteristic is the basis for the use of zinc in galvanizing or coating steel products, which over the years has ranked as zinc's most important application. The coating of zinc is corroded preferentially or sacrificially, in this way protecting the steel.

Pure zinc is highly resistant to attack by dry air except at elevated temperatures, but moist air will attack the metal superficially at room temperature, the end product under normal conditions being a hydrated basic carbonate. The properties of the zinc, both chemical and physi-

cal, vary with the grade or purity of the metal. Zinc is soluble in alkalis and acids but insoluble in water. Most of its compounds are white, and they are fairly soluble in water.

**Production.** World production of smelter zinc has shown a fairly steady increase during the last few decades, reaching a total of nearly 6 million metric tons by 1980. U. S. production peaked in the late 1960's and then began to decline. Until 1971 the United States was the world's leading producer of smelter zinc. In that year Japan became the leading producer, and by 1980, U. S. production was exceeded by that of Japan, the USSR, and Canada. Other major producers, in declining order of importance, are West Germany, Belgium, Australia, France, Poland, and Mexico.

Zinc ores are fairly widely distributed throughout the world. In the United States, Idaho, Montana, Oklahoma, Arizona, and Utah have all been major producers at one time, but the leading zinc-producing states in the late 1970's were Missouri, Tennessee, New York, and Colorado.

The zinc consumed by nations is roughly correlated with the extent of their industrial development. For example, the highly industrialized United States uses about one fifth of the world's total output of zinc.

**Technology.** The chief ore of zinc is the sulfide ( $\text{ZnS}$ ) known as sphalerite or zinc blende (see SPHALERITE). Oxidized ores of zinc, such as smithsonite ( $\text{ZnCO}_3$ ), zincite ( $\text{ZnO}$ ), willemite ( $\text{Zn}_2\text{SiO}_4$ ), the hydrated silicate hemimorphite ( $\text{Zn}_4\text{Si}_2\text{O}_{10}(\text{OH})_2 \cdot \text{H}_2\text{O}$ ), and franklinite (an oxidized zinc, manganese, and iron mineral), are also common in various parts of the world, but they have relatively little commercial significance as compared with the sulfide, and almost invariably the percentage of recovery of these ores is smaller. See FRANKLINITE; SMITHSONITE; WILLEMITE; ZINCITE.

The zinc content of ores mined has decreased steadily over the years, but improved mining and ore treatment methods have tended to compensate economically for this drop in zinc content. The fact that one or more other metals such as lead, copper, gold, silver, cadmium, and even germanium are almost always associated with zinc has permitted the exploitation of lower grade ores, although separation of these various metals has posed problems.

Since, under present-day circumstances, most zinc ores are too low grade for direct smelting, they are first crushed to free the valuable mineral particles, which are then concentrated by gravity and flotation methods. About 90% of the sulfide zinc is recovered; recovery of the much less frequent oxidized zinc content runs all the way from a few percent to 85%.

The next major step in the production of zinc metal is conversion by roasting the zinc sulfide content of the concentrates to zinc oxide. This is necessary whether electrolytic or pyrometallurgical procedures are subsequently used. A by-product of the roasting operation is sulfur dioxide-containing gas, which at many plants is converted to sulfuric acid.

In the electrolytic process, the roasted zinc concentrate (calcine) is leached with a dilute sulfuric acid solution to convert the zinc to a sulfate. The solution is then purified to remove contaminating elements such as copper, cadmium, cobalt, and germanium, and electrolyzed in suit-

ably constructed cells. The zinc, which has a high degree of purity, is deposited on aluminum cathodes, which are periodically removed from the electrolyte and stripped. These zinc sheets are melted in a furnace and cast into ingots or pigs called slab zinc in the United States, and elsewhere usually termed spelter. The process is cyclic: the electrolysis of the zinc-bearing solution regenerates sulfuric acid, and this spent electrolyte is used for further leaching of zinc calcine.

Pyrometallurgical procedure calls for the distillation of zinc from the roasted concentrate by one of three general methods. These, in the order of their development, employ: (1) batch horizontal retorts; (2) continuous vertical retorts fired by fuel; and (3) continuous vertical retorts heated electrothermally. Whatever the method, coal or coke is used to reduce the zinc oxide to zinc vapor. The zinc-containing vapor and the hot reducing carbon monoxide gas pass into condensers of various types, and the condensed metal is then cast into slabs.

Sizable operations have also been developed for the recovery of zinc from zinc-base scrap. These are carried out mainly at what are called secondary smelters, although some scrap is still treated at primary smelters.

**Grades and Prices.**—Slab zinc is available in six standard grades, varying from about 98.3 percent zinc (Prime Western, produced chiefly by the horizontal retort process) to 99.99 percent (Special High Grade, produced primarily by the electrolytic zinc process, although vertical retorts with a controlled fractionation column can also provide this grade). Between these grades, in order of increasing impurity content, are High Grade, Intermediate, Brass Special, and Select. The chief impurities are lead, cadmium, and iron. Special High Grade accounts for about 40 percent of total United States production, and Prime Western for about an equal proportion. The price of zinc varies from about 10 cents to 15 cents per pound, depending upon the grade and conditions of the metal market.

**Uses.**—As indicated previously, the major use of zinc is as a protective coating for steel, to which it is applied by some method such as hot dipping (galvanizing), electroplating, or spraying (using molten zinc). The first has become the most important method since World War II because of the rapid installation of high speed continuous galvanizing lines for steel strip. Zinc is more active in a galvanic couple than the coated iron and steel, and consequently is attacked while the coated metal is protected. See also GALVANIZING.

Another application, similar in principle, utilizing the electropositive character of zinc, is the provision of galvanic protection for underground and underwater installations of iron and steel such as storage tanks, pipelines, piers, and ships' hulls. Cast anodes of zinc are bonded to the structure to be protected. A slight galvanic countercurrent is generated due to the greater electrochemical activity of the zinc, thus protecting the iron or steel at the expense of the zinc which undergoes a controlled long term corrosion. This is called cathodic protection.

The use of zinc and zinc-base alloys for making low cost, high quality, high finish die castings has increased rapidly and now consumes approximately as much zinc as is used for galvanizing. Zinc die castings are used extensively in automobile and building hardware, electrical appliances,

tools, business machines, and toys.

Another, though decreasingly, important use of zinc is in alloying with copper to form brass, which contains from 3 to 45 percent zinc, usually about 30 percent. Still another use is the manufacture of rolled zinc to make sheet, strip, ribbon, foil, plate, rod, and wire. Typical applications are dry-cell batteries, extruded cases for radio condensers and tube shields, weather stripping, roof flashing, photoengraving plates, and anodes for cathodic protection referred to previously.

Secondary zinc finds various applications according to its analysis, the chief outlets being conversion to slab zinc, zinc dust, or brass and bronze alloys. Zinc dust, because of its physical condition, is quite reactive, and its applications depend primarily on this fact. It varies from about 95 percent to more than 99 percent metallic zinc, with zinc oxide as the chief impurity, and is sold under close specifications as to metallic content, evenness of grading, and fineness of particles. Chief outlets are in the chemical, textile, dye, paper, and metallurgical industries. It is used also in corrosion-resistant paints and coatings. When high purity is required in the zinc dust, refined zinc may be the source of the product.

**Compounds.**—The most important commercial compound of zinc is the oxide ( $ZnO$ ). The method of production is closely akin to the retort process used for the metal, since the zinc must first be produced in vapor form, whether it is to be condensed to metal or oxidized. If the zinc vapor is oxidized directly without being condensed, the product is known as American- or direct-process zinc oxide. If the zinc vapor is first condensed to metal before final vaporization and oxidation, it is known as French- or indirect-process oxide. The grades produced by each process are numerous and are controlled to give the properties desired for specific applications.

Zinc oxide is a white compound with a high refractive index, and that fact, together with its high toxicity for mildews and fungi, accounts for its wide use as a paint pigment. Still more important from the standpoint of the quantity required is the use of zinc oxide in rubber, both natural and synthetic. It aids in the curing process, increases the mechanical strength, reduces heat generation, and facilitates heat dissipation. The usual addition is about 3 to 5 percent. Other important uses of zinc oxide are in ceramics, coated fabrics and textiles, floor covering, cosmetics, and pharmaceuticals. Another article of commerce, but of much less importance, is leaded zinc oxide (5 percent or more of lead), used almost entirely in the paint-making industries.

Other than the oxide, the two most important commercial compounds of zinc are the sulfate ( $ZnSO_4$ ) and the chloride ( $ZnCl_2$ ). The chief uses of zinc sulfate are in the manufacture of rayon and for agricultural purposes—for example, in the citrus industry as a trace fertilizer and in sprays for controlling certain plant diseases. It is used also in the manufacture of chemicals, flotation reagents, and glues, and in the medicinal, rubber, and mineral industries. Zinc chloride is used for preserving and fireproofing wood, in soldering and tinning fluxes, for various purposes in the processing of textiles, and in battery making and galvanizing. Other zinc compounds of lesser commercial importance are the acetate, borate, carbonate, chromate, silicate, and sulfide,

and certain organic compounds used in driers and metallic soaps such as the palmitate, stearate, oleate, and naphthenate.

The pigment lithopone should be mentioned also, although its importance has declined markedly since 1929. It is a coprecipitated pigment of zinc sulfide and barium sulfate made by reacting solutions of zinc sulfate and barium sulfide. It finds use in such industries as paint, floor covering, coated fabrics and textiles, and rubber.

**Biological and Significance and Toxicity.** It is now established that zinc has physiological importance as a trace element in animal nutrition, appearing to be essential to growth. The total amount of zinc in the human body is estimated to be about 2 grams, or  $\frac{1}{4}$  ounce.

Ordinarily, zinc is not regarded as toxic, although the ingestion of excessive amounts with food or drink will cause disordered digestion. In general, the human skin has a high degree of tolerance for zinc and zinc salts. However, the inhalation of zinc oxide fumes, wherever they may be encountered in industrial operations, may result in distinct physiological disturbances of one or two days' duration. The effect is not cumulative, and elimination of the conditions which induced the malaise is more important than the treatment.

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**ZINCITE**, zIng'kit, a mineral,  $\text{ZnO}$ , dark red to orange when massive, but yellow when powdered. It has a hardness of 4-4.5 and a specific gravity of 5.4-5.7. A minor ore of zinc, it is associated with other zinc minerals in crystalline limestones in Sussex County, N.J., but is unimportant commercially in other districts. It crystallizes in the hexagonal system without a principal plane of symmetry. The name "zincite structure" is applied to all substances that have a similar internal geometrical arrangement of atoms; in other words, those that belong to the same space group as  $\text{ZnO}$ . Silicon carbide is an example.

C. B. SLAWSON

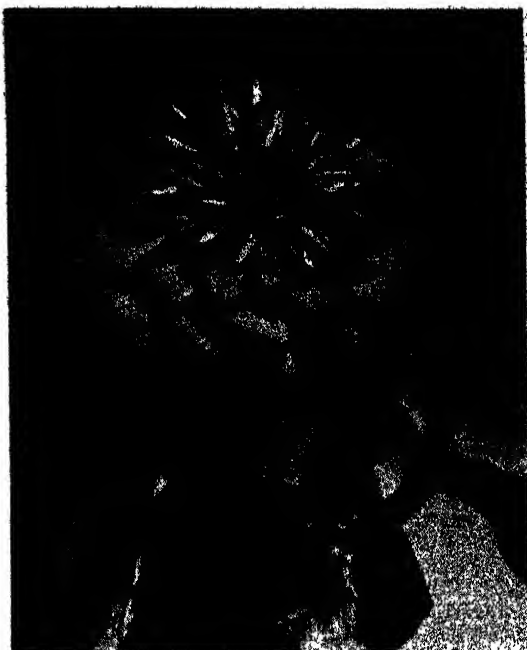
Coauthor, "Gems and Gem Materials"

**ZINDER**, zin'dar, a city in south central Niger, West Africa, about 450 miles (720 km) east of Niamey. It is situated in an area strewn with large granite boulders, and part of the city is built of red mud. Zinder is a trading and agricultural center, chiefly for millet, wheat, manioc, peanuts, beans, cattle, and sheep.

Described by the German explorer Heinrich Barth in 1853 as the "Gate of the Sudan," it was the capital of the old Emirate of Damagarim, controlled by the Kingdom of Bornu. It connected Bornu with the North African coast along the western route. The historic Kelowi salt caravan passed through Zinder. The town was occupied by the French in 1899 and was the capital of the former French colony of Niger from 1922 to 1926. Population: (1977) 58,436.

JOHN RALPH WILLIS, JR.

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The common garden zinnia (*Zinnia elegans*).

**ZINNIA**, zin'ë-ə, a genus of annual or perennial (subshrubby) plants of the Compositae family consisting of about 17 species, native to North and South America, mainly Mexico. The genus is named for Johann Gottfried Zinn (1727-1759), who was professor of medicine at Göttingen, Germany. Two species are most frequently grown as annuals.

*Zinnia elegans*, of Mexican origin, the species from which the most common garden zinnias have been developed, bears the common name "youth-and-old-age." It has stiff hairy stems and opposite leaves which are broad near the base and clasp the stem, tapering, with smooth edges, to a pointed apex. Flower heads are borne at the end of branches. They follow the pattern of having fertile male florets and fertile bisexual disc florets, but the disc is often lacking in cultivated double types. In the latter the florets occur in several overlapping, superimposed series.

The color range of available varieties of *Z. elegans* extends from white through light and deep yellow to orange, salmon, scarlet, crimson, rose, magenta, lilac, violet, and purple, and includes some bicolors. Size in this species varies according to type from 3-foot (1-meter) plants bearing 5- or 6-inch (127-152 mm) flowers to plants less than a foot (0.3 meter) high with flowers 2 inches (51 mm) or less in diameter. Particularly in the larger types, there is considerable variation in floret shape, in which curled and quilled forms have been developed.

*Z. angustifolia* is a bushy plant about a foot high, with plentiful yellow or orange heads 1-1½ inches (25-38 mm) across and available in a double variety. Florets may sometimes be marked with maroon. Zinnias are easy to grow in a sunny location and deserve their great popularity as garden flowers.

HOWARD W. SWIFT

The Garden Center of Greater Cleveland



**ZINOVIEV**, za-nôv'yaf, Grigori Yevseyevich (1883-1936), Russian Communist leader. He was born in Yelizavetgrad (Korovograd), Ukraine, on Sept. 11, 1883. After working with Lenin in organizing the Bolshevik wing of the Russian Social Democratic party in 1903, he was forced to flee from Russia in 1908.

Zinoviev spent the early years of World War I abroad with Lenin, who returned to Russia with him in 1917 when the czarist regime began to totter. Zinoviev was president of the Petrograd Soviet and became a member of the Politburo in 1918. The next year he was chosen president of the Communist International. An alleged letter by him, calling for revolution in Britain, was an issue in the 1924 election campaign when the first British Labour government was defeated.

When Lenin died, Zinoviev, Lev Borisovich Kamenev, and Joseph Stalin ruled for a short time as a triumvirate, but presently the first two joined with Leon Trotsky against Stalin. Their opposition failed, and Zinoviev was expelled from his offices and from the Communist party (1926-1927). He was readmitted to the party after recanting his views, but in 1935, after being accused by Stalin of complicity in the murder of Sergei Mironovich Kirov, he was convicted of treason and conspiracy and was sentenced to 10 years in prison. In 1936 he was tried again with many other leaders on charges of plotting with foreign powers against Stalin. He confessed to various fabricated treasonable acts and was executed in Moscow on Aug. 25, 1936. In 1988 the Soviet Supreme Court annulled the sentences of Zinoviev, Kamenev, and other Bolshevik leaders who had been condemned in Stalin's show trials.

**ZINZENDORF**, tsin'tsân-dôrf, Nikolaus Ludwig, Count von (1700-1760), German religious leader. He was born in Dresden, Saxony, on May 26, 1700. His parents were devoted to Pietism, and Philipp Jakob Spener, founder of that movement, was his godfather. He was educated at the University of Wittenberg. By birth and training he was fitted to serve as a courtier, but his deep religious vocation made him unhappy in a minor post at the court of the king of Saxony in Dresden. He came to his life work almost accidentally when in 1722 he permitted some members of the Moravian sect, fleeing from persecution in Austria, to settle on his estate near Dresden. Their small village, which was given the name Herrnhut (the Lord's Watch), occupied more and more of his time, and in 1727 he resigned his court place and devoted himself to this community as a spiritual father.

Zinzendorf's most characteristic theological emphases were upon a personal conversion to Christ and a constant close personal fellowship with him. These principles can be seen in his plans for the "brotherhood" at Herrnhut. Zinzendorf insisted that its members take the sacrament from the Lutheran parish priest, but the spirit of the group had little in common with Lutheranism. The whole community was divided into "choirs" determined by the age, sex, and marital status of the members, and it has been described as a monastic system based upon the family.

In 1734, Zinzendorf was ordained a Lutheran minister, possibly believing that this would silence some of the criticism that was being directed against him. Nevertheless, in 1736 he was exiled from Saxony because the authorities

feared that he was creating a sectarian denomination on his estate. In 1737 he was ordained a bishop of the Moravian Church. The Saxon authorities did not repeal his banishment until 1747, and Zinzendorf spent the rest of his life moving among the various Moravian settlements and mission stations. He spent the year 1742 in Pennsylvania, where he was responsible for naming and establishing the Moravian community of Bethlehem. In 1749-1755 he lived in England. He died in Herrnhut, Saxony, on May 9, 1760.

On his return from America, Zinzendorf began to stress the need for a childlike response to Christ. Sentimentality, the greatest danger in Pietism, turned this teaching into an unfortunate episode known as "the sifting period," which was marked by some extravagant tendencies. This episode, though short lived, was not forgotten by Zinzendorf's opponents.

Zinzendorf wrote hundreds of hymns, many of which are still used widely outside the Moravian Church. His main achievement was to revive the scattered and virtually extinguished Moravian Church, to mold it into a brotherhood based on an evangelical pietistic theology, and to give it a worldwide vision for missionary service.

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**ZION**, zi'an, or **SION**, si'an, a synonym for Jerusalem. Originally it was the name of a Jebusite fortress on the southeastern hill (called Ophel) of the present city. After David captured it (about 1000 B.C.), it became known also as "the city of David."

When David moved the ark of Yahweh to Araunah's threshing floor, on a site north of the original stronghold, and especially after Solomon built the Temple there, the name Zion was gradually transferred to this area and received a sacred meaning (II Samuel 6:10-12; I Kings 8:1 ff.; II Chronicles 3:1 ff.). By extension, it came to be applied to the cultic "dwelling" of Yahweh on earth (Isaiah 8:18; and about 200 other references in the Old Testament, the Apocrypha, the Pseudepigrapha, and the New Testament). The term was used also for the congregation of the post-Exilic Jews (Psalms 126:1; 129:5; Isaiah 33:14); the true Israel (Romans 9:33; 11:26; Hebrews 12:22; I Peter 2:6); and the age to come (Revelation 14:1).

During the Christian era, the population of Jerusalem moved to the western hill, which is known as Sion to this day. It contains the so-called Tower of David (a Herodian structure); and the traditional sites of Joseph Caiaphas' palace, the Cenaculum (place of the Last Supper), the Dormition of the Virgin (place of Mary's death), Nebi Daoud (Frankish and Muslim tomb of David), and St. Peter in Gallicanté ("at the cock's crow").

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**ZION NATIONAL PARK**, zī'ən, a national park in southwestern Utah, mostly in Washington county. Covering 147,035 acres (59,550 hectares), the park is a region of deep, narrow canyons with vertical walls, massive rocky domes, and pinnacles of gorgeous colors, mostly varying tones of red. The park is open all year.

Notable features of the park include Sentinel Mountain (7,157 feet, or 2,182 meters), the Watchman, East Temple, the Great White Throne (6,744 feet, or 2,055 meters), Angels Landing, and Cathedral Mountain.

Zion Canyon, which is nearly half a mile (0.8 km) deep and 8 miles (13 km) long, was cut by the North Fork of the Virgin River, which falls 50 to 70 feet (15–21 meters) in a mile (1.6 km). The park may be entered by the Zion Canyon Road (state highway 15) from the south, above Springdale, the park headquarters. At the Zion Canyon Junction, one may continue north or turn east on the Zion-Mt. Carmel Highway, which climbs by a series of six switchbacks to the mile-long Zion-Mt. Carmel Tunnel. A number of open galleries in the tunnel walls provide sweeping views of the canyon.

Much of the park consists of undeveloped country. Vegetation varies according to terrain and altitude, from cactus and yucca through broad-leaved trees such as cottonwood, ash, and maple, to pinon pine and juniper, with pine and fir at higher elevations. Wildflowers include datura, columbine, shooting star, monkey flower, and the white evening primrose. Rocky Mountain mule deer and mountain lions are fairly common, and smaller animals are abundant. The birdlife includes many species.

Zion Canyon was discovered in 1858, and the region was settled about 1861 by Mormons from the Great Salt Lake Valley, who gave it the name of Zion, "the heavenly city of God." It was set aside as Mukuntuweap National Monument in 1909 and was established by Congress under its present name in 1919. The area of Zion National Monument (Kolob Canyon), created in 1937, was added to the park in 1956.

**ZIONISM**, zī'ən-izm, the age-old Jewish aspiration and the modern movement to return to the Land of Israel. The term was coined in 1893 by Nathan Birnbaum, an Austrian author.

The longing of the Jews for their ancient homeland resulted in 538 B.C. in the return of Babylonian exiles and the establishment of the second Jewish Commonwealth, which survived for more than six centuries until it was destroyed by the Romans in 70 A.D. Thereafter, for 18 centuries, the Jews nevertheless always had a community in Palestine. Most Jews, however, lived in the Diaspora, where daily and on holidays they prayed for redemption, the ingathering of the exiles, and the restoration of David's throne in Zion—that is, Jerusalem. Through the ages a trickle of Jews settled in the Holy Land.

The First Aliya (Hebrew for "going up," or immigration) from Russia and Rumania, consisting of members of the Hoveve Zion (Lovers of Zion) movement, began in 1882. They established a number of agricultural settlements in Palestine, which, from 1890, had the support of the French Jewish financier Baron Edmond de Rothschild.

Theodor Hérzl, a Jewish correspondent for an Austrian newspaper, witnessed the anti-Semitic manifestations that accompanied the trial in Paris



UNION PACIFIC RAILROAD PHOTO

Utah's Zion National Park is a spectacular region of many-colored canyons and towering sandstone cliffs.

of Alfred Dreyfus, a Jewish captain in the French army who was accused of treason. In his book *The Jewish State* (1896) Herzl advocated the establishment of a Jewish state as the only solution to the Jewish question. Within a year he created the World Zionist Organization, and in August 1897 he convoked the First Zionist Congress in Basel, Switzerland, which signaled the birth of political Zionism. Herzl devoted the remaining years of his life to securing a charter from Turkey for an independent Jewish Palestine and to organizing Zionist institutions, such as the Jewish Colonial Trust (1898) and the Jewish National Fund (1901).

Zionist activity in the Diaspora brought a renewed wave of immigration to Palestine with the Second Aliya of 1904–1914. The number of rural settlements increased; the first kibbutz (communal village), Degania, and the city of Tel Aviv were founded in 1909; and the Technion (later Israel Institute of Technology) was established in Haifa in 1912.

Zionist leaders, headed by Chaim Weizmann (later the first president of Israel), spurred the British government in 1917 to issue the Balfour Declaration in which Britain undertook to facilitate the establishment of a Jewish national homeland in Palestine. The declaration was endorsed by France, Italy, and other European powers, and Zionists in the United States secured the support of President Woodrow Wilson.

After World War I the Allied powers approved the declaration, and the League of Nations awarded a mandate for Palestine to Britain in 1922. Sir (later Viscount) Herbert Samuel served as the first high commissioner for Palestine (1920–1925). The Third and Fourth Aliya (1919–1928) brought middle-class elements into the country and signaled the beginnings of its industrial development. The Zionist congresses became virtually a parliament for the movement, with meetings every two years in a central or west European city. Numerous parties—notably General Zionists, Mizrahi, Poale Zion, and Revisionists—were represented.

In 1929, under the leadership of Weizmann, the World Zionist Organization was expanded into the Jewish Agency for Palestine in which Zionists and non-Zionists could cooperate in the rebuilding of a Jewish national home. Jewish

immigration to Palestine from Germany and central Europe increased with Hitler's rise to power. The Fifth Aliya (1929–1936) brought 188,000 legal and 12,000 illegal Jewish immigrants to Palestine, and by 1936 the number of Jewish residents had increased to 400,000, or 30.6% of the total population of the country. Arab resentment at the growing Jewish presence resulted in riots in 1929 and 1936.

In 1939, on the eve of World War II, the British government, trying to win Arab support, issued a White Paper calling for a halt to Jewish immigration and severe restrictions on land purchases by Jews. During the war the center of the Zionist movement shifted from Europe to the United States, and one of its central tasks was the rescue of endangered Jews on the continent. The effort was largely futile. The United States and its allies gave chief priority to defeating Germany, and no country was willing to admit large numbers of refugees. The number of Jews allowed by the British to enter Palestine was insignificant in relation to the need. Faced with the enormity of the Holocaust, American Zionist organizations endorsed the Biltmore Program (May 1942), demanding the establishment of an independent Jewish state ("commonwealth") in Palestine.

After the war, the Zionist leaders recognized that only a Jewish state in a partitioned Palestine could win the approval of the United Nations. Finally, on Nov. 29, 1947, the UN General Assembly passed a resolution to partition Palestine into separate Jewish and Arab states. Britain announced that it would withdraw its forces. On May 14, 1948, the State of Israel was proclaimed in Tel Aviv by David Ben Gurion, with immediate recognition by the United States and the Soviet Union. On the very day of its birth Israel was attacked by the neighboring Arab states. An unbroken front of Arab hostility was maintained for more than 30 years until Egyptian president Anwar el-Sadat made his historic visit to Jerusalem that resulted in the Israeli-Egyptian peace treaty of 1981.

Throughout its existence Israel relied on the Zionist movement for aid in bolstering its economy and defense forces, in securing immigrants to increase its manpower and agricultural and industrial output, in furthering its technological development, in maintaining its high standards in science and medicine, and in countering growing Arab influence in the United Nations and other international bodies. By the 1980's, practically all Jews of the Diaspora had become committed to Zionism at least in the sense of supporting Israel.

RAPHAEL PATAI

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**ZIONIST ORGANIZATION OF AMERICA (ZOA)**, a constituent of the World Zionist Organization, with national headquarters in New York City. It was organized in 1897 as the Federation of American Zionists and adopted its present name in 1915. The World Zionist Organization was originally formed to work for the establishment of a homeland in Palestine for the Jewish people, an aim that was attained with the creation of the State of Israel in 1948. The Zionist Organization of America now seeks to safeguard the independence of Israel as a free and democratic commonwealth, to assist in its economic development, and to promote Jewish cultural creativity.

**ZIRCON**, zûr'kôn, in mineralogy, the native zirconium silicate,  $\text{ZrSiO}_4$ . Its crystals are tetragonal and isomorphous with thorite, zenotime, cassiterite, and rutile. Though its crystal forms are extremely varied, they are usually prisms terminated by pyramids. Small crystals frequently show a wealth of faces, among which the "zirconoid," or ditetragonal pyramids, are prominent. Zircon is a heavy mineral, its specific gravity varying from 4 to 4.8, and it has a characteristic adamantine luster. Though it is often nearly or quite opaque, transparent crystals are not uncommon. Owing to its hardness (7–7.5), strong double refraction, and the variety of rich colors in which it is found, it has long been prized as a gem. Its dispersive power is excelled only by the diamond. Hyacinth or jacinth includes reddish, orange, or brownish gem stones, which can be turned colorless by extreme heat, and then are marketed as "Matura diamonds." Jargon or jargon is the name of the colorless, yellowish, grayish, or smoky varieties.

The finest zircon gems come from Ceylon and New South Wales, Australia, while excellent translucent to opaque crystals occur in Arendal, Norway; the Ural Mountains, USSR; Ontario and Quebec, Canada; Essex and Orange counties, N.Y.; the Pikes Peak district, Colo.; and Henderson County, N.C. The mineral is also found in Florida and California. Quantitatively, Brazil and India are important sources.

**ZIRCONIUM**, zûr-kô'nē-əm (symbol Zr), a metallic chemical element with atomic number 40. Zirconium was discovered by Martin Heinrich Klaproth in 1789 while he was studying some semiprecious stones from Ceylon. It is in Group IVb in the periodic classification of the elements, along with hafnium and titanium. It has an atomic weight of 91.22, being made up of five stable isotopes of atomic mass numbers 90, 91, 92, 94, and 96, and three that are unstable, namely, 93, 95, and 97.

The known deposits of zirconium are greater than the sum of all copper, nickel, lead, tin, zinc, and mercury deposits and constitute 0.028 percent of the earth's crust. In the United States deposits occur in Florida, California, Oregon, and Idaho, and large reserves are found in Australia, Brazil, and India.

Zircon,  $\text{ZrSiO}_4$  (zirconium silicate), and baddeleyite (almost pure zirconium dioxide) are the commercial source minerals of the metal and its compounds. Zircon and baddeleyite may be decomposed into more chemically active compounds either by fusion with  $\text{NaHSO}_4$  (sodium bisulfate) or  $\text{Na}_2\text{S}_2\text{O}_7$  (sodium pyrosulfate) or by the action of strong reducing agents, such as carbon, in an arc furnace.

**Uses.** Because zirconium has a very low tendency to absorb slow neutrons and a remarkable resistance to corrosion over the wide range of conditions that can occur in reactor service, it is extremely useful in the field of nuclear energy. Other uses include surgical instruments, pins, screws for bone repairs, spinnerets for the spinning of rayon fibers, alloys, and powder metallurgy. The metal in powdered form is used as an ammunition primer, in smokeless flash powders, in blasting caps, and as a "getter" in vacuum-tube manufacture.

**Compounds and Their Uses.** Zircon, the chief ore of zirconium, is extremely inert chemically and is stable up to about 1500° C, above which it dissociates into zirconia,  $\text{ZrO}_2$ , and silica,  $\text{SiO}_2$ . Gem zircon has a hardness of 7–7.5 and the highest specific gravity (4–4.8) of any commercial gem. When zircon is heated with soda, lime, or potash in the presence of acids, zirconates are formed. Zirconium carbide is produced by heating zircon with carbon in an arc furnace:  $\text{ZrSiO}_4 + 4\text{C} \rightarrow \text{ZrC} + \text{SiO} + 3\text{CO}$ . The carbide melts somewhat above 3500° C and is extremely hard and refractory. It burns in air upon removal from the arc furnace, forming reasonably pure zirconium dioxide.

Zirconium tetrachloride, tetrabromide, and tetraiodide are manufactured industrially by reacting the respective halides with zirconium carbide in the presence of carbon. The trichloride and dichloride also exist, as do the corresponding bromides and iodides. The tetrahalides are all colorless crystalline compounds that sublime at about 300° C and above and, except for the tetrafluoride, readily hydrolyze to form the oxyhalides, such as  $\text{ZrOCl}_2 \cdot 8\text{H}_2\text{O}$ . Salts of the composition  $\text{M}_2\text{ZrF}_6$  and  $\text{M}_3\text{ZrF}_7$ , fluozirconates, are formed by the reaction of fluozirconic acid with alkalis.

Zirconium oxychloride or zirconyl chloride,  $\text{ZrOCl}_2 \cdot 8\text{H}_2\text{O}$ , is a colorless crystalline substance readily soluble in water and in alcohols. It is used in pharmaceuticals, in water repellents, and in the preparation of printing-ink pigments from acid dyes by precipitating these dyes from aqueous solution to form compounds of intensely colored solids.

Zirconium dioxide, or zirconia, is the only stable oxide under ordinary conditions, although  $\text{ZrO}$  and  $\text{ZrO}_3$  are also known to exist. Zirconia is a white crystalline substance that melts at 2677° C and is extremely unreactive at room temperature. It finds use in resistors, enamel pigments, radiography, refractories, as an abrasive, and as a raw material in preparing metallic zirconium and zirconium compounds.

Hydrous zirconia,  $\text{ZrO}_2 \cdot x\text{H}_2\text{O}$ , is precipitated when alkali is added to a solution of zirconium salt. A number of uses result from its remarkable adsorptive and complexing properties. Hydrous zirconia precipitates urushiol, the active irritant of poison ivy, and is therefore useful in the treatment of poison-ivy dermatitis. It is also used in deodorants.

There are many compounds in which oxygen or nitrogen form a link between zirconium and carbon: Zirconium triacetylacetonate, the compound resulting from the chelation of acetylacetonate with  $\text{Zr}^{4+}$ , is a typical example of zirconium exhibiting a coordination number of 8. Coordination compounds of zirconium are used as catalysts for ammonia synthesis, organic oxidations and syntheses, esterifications, cracking, polymer-

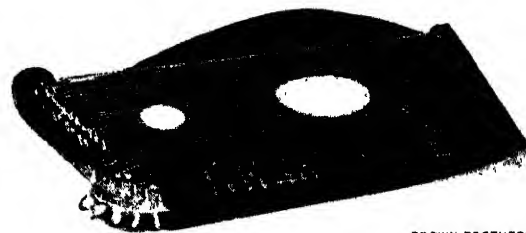
izations, and in the conversion of sulfur dioxide to sulfur trioxide. Disulfate zirconylic acid is the best-known sulfate and is used in the tanning of leather and in the precipitation of amino acids.

**Production.** Metallic zirconium can be produced by the Kroll process, which involves the purification of zirconium tetrachloride by sublimation and the reduction of the tetrachloride vapor by molten magnesium. The van Arkel process gives a purer metal but is more costly and is not suitable for quantity production of metallic zirconium. It involves the dissociation of zirconium tetraiodide and the deposition of zirconium on a metal filament at about 1300° C. The deposited zirconium has high ductility but low tensile strength.

Unless special separation methods are used in these processes, the zirconium produced contains from .5 to 3 percent hafnium, the reason being that zirconium and hafnium have very similar properties and always occur together in nature. Zirconium can be separated from hafnium by means of various processes. These separation methods include fractional distillation, fractional crystallization, column chromatography, and solvent extraction.

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**ZITHER**, zith'ər, a musical instrument native to Austria and southeastern Germany. It consists of a flat wooden sound box across which from 30 to 45 strings are stretched. It is played in a horizontal position, placed on a flat surface or held on the player's knees. The four or five strings closest to the player are stopped by being pressed down against a fretted board by the player's left thumb; they are plucked with a plectrum



BROWN BROTHERS

The zither.

attached to the right thumb. The other (open) strings are plucked by the three middle fingers of the right hand to supply a wavering accompaniment. The name "zither," which like "guitar" is derived from the Greek *kithara*, also is applied to one musicological classification of the plucked stringed instruments otherwise referred to as psalteries, as distinct from the somewhat similar dulcimers, which are struck with small hammers. The Hungarian Gypsy cimbalom, which is often commonly thought of as a zither, is in reality a large dulcimer.

HERBERT WEINSTOCK  
*Coauthor of "Men of Music"*

**ZITTAU**, tsit'ou, a town in East Germany, on the west bank of the Neisse River, near the borders of Czechoslovakia and Poland. It is situated 50 miles (80 km) east of Dresden. Its industries

include cotton spinning and the manufacture of dress goods, iron-founding machinery, small motorcars, and radios. Zittau lost its coal mines when the territory east of the Neisse River was placed under Polish administration in 1945. The city was partly destroyed in the Thirty Years' War (1618-1648) and the Seven Years' War (1756-1763). Still standing are the Cross Church (Kreuzkirche) of 1410, the Peter-Paul Church of the 14th century, and a Renaissance building housing the library and museum. Zittau dates back to 1238 and was chartered in 1255; it became part of Saxony in 1635. After World War II it was included in the German Democratic Republic (East Germany), from 1952 in Dresden District. Pop. (1983) 40,983.

**ZIZANIA**, zə-zā'nē-ə, a genus of three species of grasses. They include the wild or Indian rice of North America, *Zizania aquatica*, the grains of which were used as food by the Indians and are still sold commercially; the Asiatic *Z. latifolia*, the thickened stem bases of which serve as a vegetable; and *Z. texana*, the Texas wild rice, found only around San Marcos, Texas. See also GRAIN; RICE.

EDWIN B. MATSKE.

**ŽIŽKA**, zhīsh'kă, Jan, Bohemian general and Hussite leader; b. Trocnov, Bohemia, c. 1358/1360; d. Pribyslav, Oct. 11, 1424. The name Žižka (One-Eyed) probably was given to him when he lost an eye in childhood. After serving in the feudal bands of various lords, he went to Poland with the army sent by King Wenceslas IV of Bohemia to fight the Teutonic Knights, and distinguished himself in the victory of Tannenberg (1410). On his return he remained at court as one of Wenceslas' favorites and became an adherent of the church reform advocated, among others, by Jan Hus (q.v.).

After Wenceslas' death (1419), the Czechs repudiated Sigismund, the Holy Roman emperor, as heir to the Bohemian throne; but the atmosphere in Prague was conciliatory, and Žižka and his friends left for the more uncompromising city of Plzeň (Pilsen). Within a year, he and some 400 fighting men and their families had established themselves on the fortified hill that they called Tabor, and Žižka became the revolutionary military commander of the armed brotherhood of Taborites, who held that the "law of God" must be defended by the sword against its enemies and accordingly assumed the name of "warriors of God" (see also HUSSITES). Žižka proved a resourceful and imaginative military leader. He used wagons with guns mounted on them as mobile defensive strong points and on at least one occasion employed them as tactical offensive vehicles.

In 1420, when Sigismund besieged Prague with a large army, Žižka, with a much smaller force, occupied the heights called Vítkov and defended them so successfully that Sigismund withdrew without attempting to take the city; since then, the heights have been known as Žižkov. Žižka continued to campaign, although he was nearly or totally blind after being wounded in his remaining eye at the siege of the castle of Rábi in 1421. He defeated Sigismund at Plzeň and early in January 1422 at Kutná Hora and Německý Brod.

In 1423 there occurred a break between Žižka and the Taborites for reasons still variously ex-

plained, and he took command of another center of radical Hussitism in eastern Bohemia around Hradec Králové, but known from its mountain fortification as Horeb. In the civil wars that followed, Žižka won several victories, notably at Malešov (June 7, 1424), over the Prague party. He died of the bubonic plague at the castle of Pribyslav and was buried at Hradec Králové, but when his forces, which assumed the name of Orphans, lost control of that city, his relics were transferred to Čáslav.

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Waldo Professor of Church History, Emeritus,  
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**ZIZYPHUS**, zīz'ə-fəs, a genus of some 100 species of tropical and subtropical shrubs or trees, mostly Asiatic and Mediterranean, in the buckthorn family, Rhamnaceae. The best-known species, *Zizyphus jujuba*, is the common jujube, a usually spiny shrub or small tree, up to 30 feet in height. It has alternate, oval, finely toothed, 3-veined leaves, 1 to 2 inches in length, and small yellow flowers with 5 sepals, 5 petals, 5 stamens, and 1 pistil. This ripens into a dark red, oval drupe about the size of a green olive. The species occurs from the eastern Mediterranean region to China and Japan, and is widely cultivated to a limited extent also in warmer parts of the United States. The fruits are edible, and they are also used medicinally in cough medicines. The bark and leaves are utilized in tanning, while in Asia the leaves of the zizyphus serve as food for silkworms, and the lac insect thrives on the twigs.

*Z. mauritiana*, a related species native to Asia, Africa, and Australia, has broader leaves, densely hairy on the lower surface. It is also cultivated, in numerous varieties, for its fruits, which are often known as "Chinese dates" and are eaten either fresh, dried, or candied. The red hard durable wood of both of these species is commercially important.

*Z. lotus* is a smaller-leaved shrub of the Mediterranean area. Its edible fruits are not as large, and they may have been the lotus of the lotus-eaters of antiquity. *Z. spina-Christi* is a small thorny tree of northern Africa and western Asia. Either its twigs or those of a related genus, *Paliurus*, were probably used in the crown of thorns that Christ was forced by his tormentors to wear. A Brazilian species, *Z. joazeiro*, grows in dry places, and its fruits furnish food for domesticated animals.

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**ZLATOUST**, zla-tū-ōst', city, USSR, in Chelyabinsk Oblast of the Russian SFSR, in the southern Ural Mountains, 75 miles west of the city of Chelyabinsk. Situated on the Ay River, where it turns west to cut through the Urals, Zlatoust has rail connections with Chelyabinsk and the oil city of Ufa to the west. The city was founded in 1754 in conjunction with the building of the Kosotursk (later Zlatoustov) ironworks, and is noted for its quality metallurgy and machinery manufactures. It is claimed that the art of engraving on metal was first developed in Zlatoust early in the 19th century. The city was the home of the Russian metallurgist Pavel Petrovich Anosov (1797-1851), who developed a new method of obtaining quality steel. Before 1917 Zlatoust



produced small amounts of fine steel, and the facilities were enlarged considerably during the 1930's. During World War II the city was a major supplier of high quality alloy steels for Soviet aviation and other war industries. It also produces instruments, machine tools, and parts for agricultural machines, as well as abrasives and chemicals. Pop. (1959) 161,000.

W. A. DOUGLAS JACKSON.

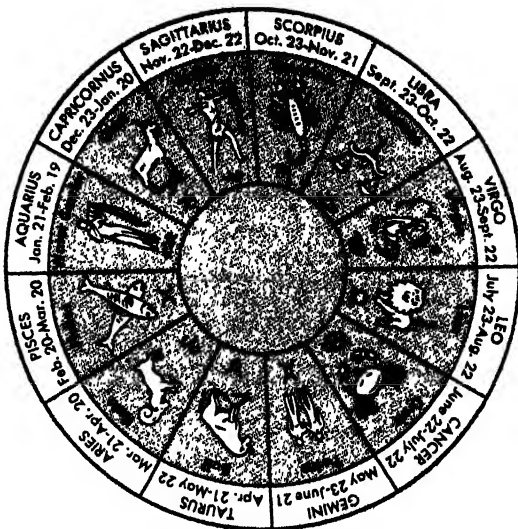
**ZNOJMO**, znoi'mô (Ger. **ZNAIM**), city, Czechoslovakia, near the northern border of Austria, on the Dyje River, 35 miles southwest of Brno and 42 miles north-northwest of Vienna. It is a manufacturing center, with processing plants for fruit and vegetables from the surrounding countryside, and pottery and stoneware factories. Founded in 1226, the city has a Romanesque castle dating from the 13th century, a 14th century Gothic church, and a 15th century town hall. An armistice between France and Austria was signed here in 1809. Pop. (1957) 22,681.

**ZOANTHARIA**, zô-ân-thă-rê-ă, a subclass of Actinozoa (q.v.; Anthozoa) characterized by the fact that the tentacles are simple and unbranched, that there are usually incomplete as well as complete mesenteries, and that the tentacles usually alternate in several circles. The mesenteries and tentacles are often arranged in multiples of the number six, but this is variable, and in some forms the number of mesenteries increases during the growth of the animal. The animal develops as a gastrula, the blastopore of which remains as the mouth. The larva is usually ciliated and free swimming. The Zoantharia include the sea anemones and corals; these do not represent natural divisions of the class, but merely modes of life of its members: a colonial zoantharian with a calcareous exoskeleton is a coral; an isolated zoantharian without an exoskeleton is a sea anemone. See also CORAL AND CORAL REEFS; SEA ANEMONE.

**ZOBEIR RAHAMA PASHA**, zô-bîr' rā'mā pā'shā, Egyptian pasha in the Sudan: b. 1830; d. Geili, Sudan, Jan. 5, 1913. His family claimed descent from an uncle of Mohammed. By 1860 he was a powerful slave trader along the White Nile and in the Province of Bahr el Ghazal. Zobeir maintained a private army in the area and, after crushing an attempt from Khartoum to subdue him, was made governor of the province in 1869. In 1874 he conquered Darfur for the khedive of Egypt, but when he went to Cairo in 1876 to seek the governorship of the conquered region, he was detained by the authorities. Meanwhile, his son Suleiman, instigated by Zobeir, took up arms against Gen. Charles George Gordon, newly appointed governor general of the Sudan, who was moving against the slave trade. Suleiman was captured and executed, but in 1884, when the Mahdist movement threatened, Gordon suggested that Zobeir should be appointed his successor as an expedient to halt the revolt. The British government refused to accept the former slave trader, and in 1885 he was arrested on charges of treasonous dealing with the Mahdi and deported to Gibraltar. He returned to Egypt in 1887 and after 1899 was allowed to live on his estates in the Sudan.

**ZODIAC**, zô'dē-āk, an artificial belt on the celestial sphere extending 8° on either side of the

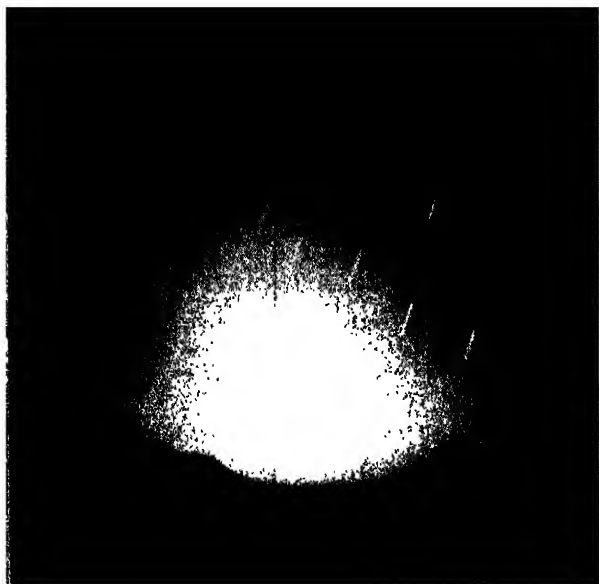
ecliptic (q.v.). It is arbitrarily subdivided into 12 equal sections, 30° long, which bear the names of the zodiacal constellations. These sections, or *signs*, are traversed successively by the sun in its apparent annual motion. The moon and planets, except Pluto, never stray more than 8° from the ecliptic; thus they also remain within the zodiac. Counted eastward from the vernal equinox, the signs are Aries (the Ram); Taurus (the Bull); Gemini (the Twins); Cancer (the Crab); Leo (the Lion); Virgo (the Virgin); Libra (the Balance); Scorpius (Scorpio; the Scorpion); Sagittarius (the Archer); Capricornus (the Goat); Aquarius (the Water Carrier); and Pisces (the Fishes).



The signs of the zodiac.

The names of the zodiacal constellations are very ancient, dating from the early Babylonian period and possibly from the Sumerians, except Libra, which was originally a part of Scorpius called Chelae (the Claws). The zodiac itself, on the contrary, is a mathematical concept which does not appear to have been in use prior to 400 B.C. Its purpose was to provide a frame of reference in which the positions of the sun, moon, and planets could be expressed by their angular distance from the beginning of the sign in which they were located. This device was used only in calculating predicted positions; in actual observations, positions had to be measured with respect to known bright stars, because the subdivisions of the zodiac have no visible counterpart in the sky.

About 100 B.C. it became the established practice to place the beginning of Aries at the vernal equinox. (For that reason the term "First of Aries" is still used occasionally as a synonym for vernal equinox.) This unfortunate choice played a decisive part in the eventual disuse of the zodiac for astronomical purposes. The equinoxes are located at the intersections of the celestial equator with the ecliptic; the position of the celestial equator, in turn, depends on the location of the north celestial pole, that is, on the orientation in space of the earth's polar axis. Because the earth is not perfectly spherical, its polar axis undergoes a slow movement of preces-



D.E. Blackwell and M.F. Ingram

**Zodiacal light.** The streaks show paths of stars across the fixed-camera field during a 10-minute exposure.

sion, which causes a corresponding displacement of the equinoxes, westward along the ecliptic, amounting to about  $1^\circ$  in 70 years (see also PRECESSION OF THE EQUINOXES). Accordingly, the zodiacal signs no longer coincide with the zodiacal constellations of the same name, and the First of Aries is now located in the western part of the constellation Pisces. The zodiac is no longer of practical use in astronomy.

See also ASTRONOMY; CONSTELLATION; and separate articles on individual constellations.

SIMONE D. GOSSNER

**ZODIACAL LIGHT**, zō-dī'ə-kəl lit, a luminous band of the celestial sphere, confined to the region of the zodiac (q.v.). Extremely faint, it is visible in the west immediately after sunset and in the east shortly before sunrise, in the form of a pyramid of light whose brightness decreases with increasing distance from the sun. The extent to which it may be traced depends on the observer's acuity of vision; on the average, it is seldom seen beyond  $45^\circ$  from the sun. At intermediate latitudes it is observable only when the zodiac reaches its greatest elevation above the horizon, in the evening sky in early spring and in the morning sky in early autumn. At all other times it is too close to the horizon and is dimmed beyond the limit of visibility by haze and dust. In the tropics, where the zodiac is nearly vertical throughout the year, it may be observed at all seasons.

Spectroscopic observations have proved that the zodiacal light is not self-luminous. It arises from the reflection and diffraction of sunlight by myriad small particles scattered through the entire solar system. Hendrik C. van de Hulst has shown that its observed brightness may be accounted for by assuming the existence of a cloud of particles 0.04 inch in diameter, spaced 5 miles apart on the average. The cloud is disc-shaped and coincides approximately with the plane of the ecliptic (q.v.); its estimated thickness is about one tenth the diameter of the earth's orbit. Particles of that size, receiving heat from the sun and radiating it back into space, gradually spiral

in until they fall into the sun (Poynting-Robertson effect). Therefore, the particles that currently produce the zodiacal light must be of relatively recent origin; they are presumed to come from the gradual disintegration of comets and the dust produced by the continuous grinding of asteroids.

See also GEGENSEHIN; SOLAR SYSTEM—Interplanetary Dust and the Solar Wind.

SIMONE D. GOSSNER

**ZOE**, zō'ē, empress of the Eastern Roman Empire: b. 980; d. 1050. A daughter of Emperor Constantine VIII, she succeeded to the throne on his death in 1028 and took a consort who shared the throne with her as Romanus III Argyrus. In 1034 she caused Romanus to be murdered with the aid of her paramour Michael the Paphlagonian, whom she then married and brought to the throne as Michael IV. Michael died in 1041 and was succeeded as coruler by his nephew Michael V Calaphates, whom Zoë had adopted. He imprisoned the empress and seized sole power, but was deposed in a revolt in 1042. Zoë then reigned briefly with her sister Theodora, who was a nun, but later in 1042 she took another husband, who as Constantine IX Monomachus ruled the empire jointly with both sisters until Zoë's death and then with Theodora alone until his own death in 1055.

See also CONSTANTINE IX; MICHAEL (emperors of the Eastern Roman Empire); ROMANUS.

**ZOFFANY**, zōf'ə-nē, John, Bohemian painter working chiefly in England: bap. Frankfurt am Main, Germany, March 15, 1733; d. near Kew, Surrey, England, Nov. 11, 1810. Precociously gifted, he worked in Italy and Germany before going to England about 1758. Here he came close to starvation until Benjamin Wilson, a portraitist, hired him to paint draperies at £40 a year. David Garrick seems to have been his first considerable patron. The 3d earl of Bute presented him to George III, and a long series of single portraits or conversation pieces devoted to the royal family resulted. Nobility and gentry, besides many actors, sat for him. In 1762 he became a member of the Society of Artists. He was a founding member of England's Royal Academy in 1768.

Sent to Florence by the king in 1772, Zoffany worked for two years to perfect his most famous conversation piece, *Tribuna*—the horizontal room of the Uffizi Gallery, crowded with notable Englishmen, among them Zoffany himself showing a "bargain" to Lord Cowper. This amusing pictorial document was bought by Queen Charlotte shortly after the painter's return (1779) and is now at Windsor. Zoffany had been made a baron of the Holy Roman Empire earlier in 1779. From 1783 to 1790 he was in India, with disappointing results. He redeemed himself (1790) with *Charles Towneley and His Friends in His Library* (Lord O'Hagan's collection), a piece comparable to the *Tribuna*. In the mid-1960's the best Zoffanys were still in private hands, aside from those in the royal collection. Some of his other works are in the National Portrait Gallery, London; and in Edinburgh, Glasgow, and Oxford.

WALLACE BROCKWAY

**ZOG I**, zōg, or **ZOGU I**, zōg'wə (original name AHMED BEY ZOGU), king of Albania: b. near

Burgayeti, Albania, Oct. 8, 1895; d. Suresnes, France, April 9, 1961. The son of a Muslim chieftain of the Zogolli clan in the Mati district of central Albania, he was educated at military schools in Monastir, Turkey (now Bitolj, Yugoslavia), and Constantinople (Istanbul), and was prominent in the Albanian struggle for independence in 1912-1914. Forced to flee when World War I began, he fought as an officer in the Austrian Army. In 1920 he was named minister of the interior in Albania's postwar provisional government and, as head of the national police, repelled the invading Yugoslavs. As minister of the interior again in 1921-1922, he crushed an internal revolt. Zogu became premier in December 1922 but was ousted and driven into exile early in 1924 by Bishop Fan Noli, head of the Albanian Orthodox Church. In December, however, Zogu returned to Albania to lead a successful military coup against Noli, and was chosen as the president of the Albanian republic by Parliament in January 1925. In 1928 he was proclaimed king with the title of Zog I.

An autocratic ruler, Zog undertook a program of public works with financial aid from Italy, as a result of which the country fell more and more under Italian control. In April 1939 Italian forces invaded, and Zog fled with his queen, the former Countess Geraldine Apponyi of Hungary, whom he had married in 1938, and their infant son. During World War II the family resided in England. The king was formally deposed in *absentia* in January 1946 by the new Communist-dominated Albanian regime and eventually took up residence in France. His son Skander (Prince Leka; b. 1939) succeeded him as pretender to the Albanian throne.

See also ALBANIA—History.

**ZOHAR**, zō'hār (Heb. for "splendor"), the sacred book of the Jewish Cabalists (see CABALA), written in Aramaic, ascribed to the "divine saint," Rabbi Simeon ben Yohai (2d century A.D.), but actually written or compiled by the Spanish Cabalist Moses de Leon toward the end of the 13th century. Most of it has the form of a commentary on the Pentateuch, Song of Songs, Ruth, and Lamentations, and is permeated by a mystical spirit, often strongly erotic in its imagery (for example, the description of the love between God, the bridegroom, and Israel, the bride, with the Temple of Jerusalem as their bridal chamber), resembling in this respect some of the contemporary Spanish Roman Catholic mystics. Every passage or word in the Bible is, for the Zohar, a mystery (*raza*), and this term occurs many times on each of its pages. It also contains mystic revelations received by Simeon ben Yohai, stories of his death, descriptions of the world, of paradise and hell, Messianic speculations, a detailed angelology and demonology, and discussions between the alleged author, Simeon ben Yohai, and "the faithful shepherd" (Moses) about such matters of spiritual interest as the Heavenly Academy.

The Zohar's impact on Judaism became pronounced only after the expulsion of the Jews from Spain in 1492. It was felt in the subsequent pseudo-Messianic movements of the 16th and 17th centuries, and reechoed in the Hasidism of the 18th century. Hasidic Jews still study it and regard it as a holy book. Numerous commentaries have been written on it, and it was translated in the 16th century into Latin and Hebrew and

in the 20th century into English (5 vols., 1931-34).

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**ZOILUS**, zō'a-ləs, Greek rhetorician and literary critic: fl. 4th century B.C. A native of either Amphipolis or Ephesus, Zoilus was so celebrated for the asperity with which he assailed Homer for introducing fabulous and incredible stories into his *Iliad* and *Odyssey* that he was nicknamed *Homeromastix* (Scourge of Homer). He also attacked the rhetorician Isocrates and the philosopher Plato, his contemporaries. The term "Zoilism," denoting carping criticism, is derived from his name. Zoilus' writings, of which only scanty citations survive, included, besides the diatribes against the above-mentioned authors: *Peri schēmātōn* (On Figures of Speech); *Peri Amphipoleōs* (On Amphipolis), in three books; *Tenediōn enkōmion* (Encomium on the Tenedians); and *Historia apo theogoniās heōs tēs Philippou teleutēs* (History from the Theogony to Philip's Death), a history from the creation of the world to the death of King Philip II of Macedon (336 B.C.).

P. R. COLEMAN-NORTON.

**ZOISITE**, zoi'sīt, a mineral closely related to epidote (q.v.), named by Abraham Gottlob Werner in 1805 in honor of Baron Sigismund Zois von Edelstein (1747-1819), who discovered it. It is a basic orthosilicate of calcium and aluminum,  $\text{HCa}_2\text{Al}_2\text{Si}_2\text{O}_{12}$ . The aluminum is sometimes partly replaced by iron, the mineral thus approaching epidote in composition. Though its crystals are orthorhombic, their form is very similar to the monoclinic epidote. Its hardness is 6 to 6.5 and specific gravity about 3.3. Its color is usually dull gray or brown, but in the variety thulite, found in Norway, it is a beautiful rose pink. Zoisite is found in many European localities and also abundantly in the New England states, Pennsylvania, and North Carolina, and in exceptionally good crystals at Ducktown, Tenn.

**ZOLA**, zō'la, Fr. zô-la', **Émile (Édouard Charles Antoine)**, French novelist: b. Paris, France, April 2, 1840; d. there, Sept. 29, 1902. His development as a writer began during his youth at Aix, where he and his friend Paul Cézanne started out by imitating the romantics. His widowed mother wanted him to study law, but he failed to win his baccalaureate and in 1860, after two months as an ill-paid clerk on the Paris docks, abandoned himself for a year and a half to the garret life of an impoverished poet. This attempt at verse ended in failure and was followed by a period of reaction to romanticism and further growth in the direction of realism. As a publicity chief at Louis Christophe Hachette's bookshop, he learned what made writing sell. As a vigorous literary columnist and art critic on *Cartier de Villemessant's* newspapers, he mastered the techniques of sensational journalism. In 10 formative years he wrote numerous short stories and essays, 4 plays, 2 long pieces of commercial fiction, and 3 serious novels—*La confession de Claude* (1865), *Thérèse Raquin* (1867), and *Madeleine Féral* (1868).

Influenced by Honoré de Balzac, Stendhal, Gustave Flaubert, and Hippolyte Taine, Zola formulated his aesthetic principles, including his

definition of art as "nature seen through a temperament." He further expressed his belief that true artistic originality can best be achieved only by a rejection of tradition and a total submission to the life of one's own times, and he was convinced that science offers the writer a



Émile Zola

The Bettmann Archive

superior method of approaching reality. In 1868, armed with these ideas, he submitted to his publisher the plan for a group of novels, *Les Rougon-Macquart*, portraying the fortunes of a family under the Second Empire and through this frame the whole turmoil of his age. At first limited to 10, the series ultimately comprised 20 volumes (see ROUGON-MACQUART, LES), ranging in subject from the world of peasants and workers to the imperial court, and in type from shocking exposés to lyrical fantasies and sustained epics. Yet, although he liked to astonish the public with his virtuosity, his method of composition changed little over the years. First methodically assembling his research data, plot ideas, and character sketches under separate analytical headings, he then combined all this material in chapter plans with a complex art anticipating the techniques of film montage. Finally, with this scenario to guide him in the writing stage, he was free to concentrate on his style, which was remarkable for frequently rhythmic repetition, visual impressionism, and force.

Starting with the publication of *L'assommoir* (1877), a tragic study of life in the Paris slums, Zola became world famous, bought an estate at Médan, and attracted imitators and disciples. From 1879 to 1882, to consolidate his success, he waged a lively publicity campaign supporting naturalism. Inspired by Claude Bernard's *Introduction à la médecine expérimentale* (1865), he even wrote a treatise (*Le roman expérimental*, 1880) picturing the naturalist author as a scientific observer following his fictional human guinea pigs through lifelike situations and thereby verifying certain psychological and social hypotheses. Yet, despite such efforts to build a public image of himself as a scientist, he was at his best, not when trying to apply specific scientific or pseudoscientific theories, but when giving imaginative expression to the new subjective vision of reality that modern science and technology had helped shape.

Essentially, like other great realists, Zola was an "illusionist" who excelled at imposing his intuition of the world under the guise of plain, unvarnished fact. This method may be seen in *Germinal* (1885), generally considered one of his finest works. The first major novel on a strike,

it may be appreciated either as a factual social document or as a prose epic, a lurid yet sublime "poem," in which his research notes on class warfare and labor conditions in the coal mines grow into dreamlike symbols and Dantesque descriptions often bordering on hallucinations. As elsewhere in his novels, objects are brought to monstrous life, animals assume human traits, crowds become forces of nature, and individual characters are transformed into types, allegories, and symbols. Underlying this synthesis of realism and symbolism, which is the triumph of Zola's art, are the poetic themes which provide the *Rougon-Macquart* novels with their deepest unity: above all, a sense of cosmic upheaval, of world destruction and renewal involving a cyclical view of history and a materialist philosophy in which little remains of the Christian-humanist tradition. It is a philosophy in which, as Jules Lemaitre said, "men appear like waves on a sea of darkness and unconsciousness."

After the enormous *Rougon-Macquart* project, Zola undertook to expound his social gospel based on a creed of hard work and justice in a trilogy (*Les trois villes*, 1894-98) and an unfinished tetralogy (*Les quatre évangiles*, 1899-1903); but never again attained the power of such masterpieces as *L'assommoir* and *Germinal*. On Jan. 13, 1898, he went to the defense of Capt. Alfred Dreyfus by publishing in *L'aurore* a letter, "J'accuse," pointing out irregularities in Dreyfus' trial and making charges that practically forced the government to prosecute him, an expedient that achieved its purpose in reopening the Dreyfus case and led to the complete vindication of that officer. In February 1898 a verdict imposing imprisonment and fine was brought against Zola, but it was quashed by the Cour de Cassation on April 2. A second trial was called and Zola, his purpose accomplished, decided not to appear and went to England, where he remained until an amnesty permitted his return to France. He died of asphyxiation caused by fumes from a blocked chimney in the bedroom where he was sleeping.

At Zola's funeral, Anatole France declared, "He was a moment of the human conscience." Zola had been repeatedly refused admission to the Academy, and after his condemnation in 1898 he was removed from the roll of the Legion of Honor, but in 1908 his remains were transported to the Panthéon. Although still famous chiefly as the main exponent of literary naturalism, he has undergone since about 1950 a general critical reevaluation emphasizing his powerful imaginative qualities.

See also ASSOMMOIR, L'; NANA.

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**ZÖLLNER**, tsöl'nar, **Johann Karl Friedrich**, German astrophysicist: b. Berlin, Germany, Nov. 8, 1834; d. Leipzig, April 25, 1882. He was educated at Berlin and Basel, and in 1866 was appointed professor of physical astronomy at the University of Leipzig. His numerous contributions to astronomical science included studies of comets, the constitution of the sun, and the thermal conditions of planets. Zöllner's studies of the albedo (ratio of light reflected to light received, or power of reflection) of the moon facilitated the later comparison of the brightness of the moon and the sun.

Zöllner is best known for his invention of an artificial star or comparison photometer. Among its many applications, this instrument for the first time made possible systematic and accurate visual determinations of the magnitudes of stars, and between the years 1885 and 1905 it was used at the Potsdam Observatory to compile the first great photometric catalog of bright stars in the Northern Hemisphere. With the new instrument Hermann Karl Vogel later obtained the first spectroscopic proof of the rotation of the sun by comparing the spectra of its opposite edges and thus confirmed the existence of the Doppler effect. In his later years Zöllner engaged in metaphysical speculations, studies of spiritualism, and investigations of hypnotism that aroused considerable controversy.

**ZOLLVEREIN**, tsöl'fa-rin, the German word for "customs union." In 1815, with the establishment of the German Confederation, Prussia received Westphalia, part of Saxony, and most of the territory on the left bank of the Rhine in recognition of her contribution to the campaigns ending at Waterloo. Although this seemed small reward for her prodigious efforts in the Napoleonic Wars, it enabled her once more to become one of the great European powers. However, the creation of Prussian provinces in the west separated from the main body of Prussia in the east posed great economic problems. In conveying goods to south Germany, Prussia found herself hampered by the wide variety of tariff schedules and currencies of the intervening states. Bankers and businessmen were gradually convinced that trade could be facilitated only by the abolition of local customs and that thus the cost of tariff collection could be reduced and smuggling curbed. The flooding of German markets with cheap British goods was another factor persuading Prussia's industrial leaders that the tariff must be completely reformed. A major influence leading to the formation of a customs union was the desire to help the landholders by establishing markets for their produce and in enlarging the areas in which the products could be sold.

The Prussian state was economically unified by the law of May 26, 1818, that superseded 67 provincial tariffs and became the basis of German economic policy for more than 60 years. This law, founded on free-trade principles, inspired by the philosophy of Adam Smith, and dictated by Prussia's peculiar needs, established against the rest of the world a low tariff on manufactured goods and one still lower on raw materials. However, since it taxed materials and manufactures transported through Russian territory, it served to influence her neighbors to join the union and thus, while avoiding its penalties, share in the benefits it exerted in encouraging foreign and domestic trade and in elevating the standard of living without

destroying industry's ability to compete abroad. Successful in unifying her own economic sphere, Prussia determined to extend the system. Indeed, the minister of finance, Friedrich Adolf von Motz, envisaged Prussia as the leader of a customs union embracing all of central Europe and by cajolery and economic pressure worked to advance toward this goal.

Overshadowed by Prussia, the smaller states of north and central Germany, especially those enclaved by their neighbor, were compelled to choose between federation and economic starvation. The first of these states to abandon an economic policy of its own signed a tariff treaty with Prussia in 1819, and others of the smaller states followed its example in the next seven years. The remaining German states, especially those in the south, regarded the new union with envy and Prussia's growing power with suspicion. Hoping to maintain their economic independence while reaping the fruits of collaboration, Bavaria, Württemberg, and Hohenzollern in 1827-1828 established an independent customs league, which differed from the Prussian system in that its members retained full sovereignty. A few months later Saxony, Hesse-Cassel, and Hannover initiated the formation of the Middle German Union, whose members agreed to join none of the rival associations. In 1834 Hannover, Brunswick, and Schaumburg-Lippe formed still another organization, the *Steuerverein*, or Tariff Syndicate. This multiplicity of unions, however, reduced only partially the numbers of sovereignties in economic conflict and this, joined to Prussian economic and political pressure, resulted as early as 1829 in economic collaboration between the groups in the south and east. Within a few years defectors from the earlier associations had become so numerous that Prussia felt sufficiently strong to promulgate the *Deutscher Zollverein*, or German Customs Union, on March 22, 1833, to begin operations on Jan. 1, 1834. Initially, the union comprised 26 million people and 80 percent of the territory that was to form the German Empire after 1871; the four principalities that held aloof had all joined the confederation at the time of the Franco-Prussian War, when Alsace and Lorraine were also embraced. Hamburg and Bremen refused to relinquish their advantages as free ports, but capitulated in 1888.

The charter of Germany's economic unification provided for continuous consultation among the states, division of revenues according to population, free entry for raw materials, and low tariffs on manufactures. Wishing to destroy Austria's influence in the German Confederation and fearful of the dumping of the Hungarian grain crop into Germany, Prussia refused admission into the *Zollverein* to Austria, which then united the Habsburg monarchy into an independent customs district, despite the desire of the lesser German states to effect unification to extend their own commercial sphere and thus relieve Prussian pressure. Austria was partially satisfied with a commercial treaty, terminated by the war of 1866.

The *Zollverein* exerted a powerful influence in other countries. After 1860 Napoleon III cut French import duties in a treaty with England and negotiated low tariff agreements with the German Customs Union and with seven European countries. This era of free trade came to an end, however, when Austria and Italy raised duties in 1878 and when in the next year Bismarck decided that only higher tariffs could assure German in-



dustury a secure home market against British commercial penetration. Six years later Germany raised agricultural tariffs, leaving Britain as the only proponent of the liberal principles of free trade.

In retrospect, the *Zollverein* is seen as the first step taken to unite Germany under Prussian leadership; as a strong influence in the development of the industrial Ruhr and the growth of German armament; as the factor inspiring the development of an all-embracing railway network in conformity with the demands of industry's expansion; as the influence that transformed Germany's political union under Austria into economic unification under Prussia; and as the forerunner of the European Coal and Steel Community, the European Common Market, and similar plans for economic and political cooperation through the elimination of tariffs.

See also CUSTOMS UNION; TARIFF.

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**ZOMBA**, zóm'bə, town, Malawi, capital of the republic, situated 20 miles west of Lake Chilwa, in Southern Province, on Shire Highlands, 37 miles northeast of Blantyre. The site, at the base of Zomba Mountain, lay close to the infamous slave route from the south end of Lake Nyasa to Mozambique. Yao chiefs repeatedly raided the area, selling its inhabitants to the Portuguese as slaves. Sir Harry Johnston, British commissioner for South Central Africa in 1891, established Zomba as capital of the Nyasaland Protectorate. In recent times diamond drilling has uncovered limestone deposits in the vicinity. There is also a cement works in the town. Cotton and tobacco are cultivated in the area, which contains an agricultural experiment station. The population at the 1966 census numbered 19,616 and included, besides Africans, a number of Europeans, Asiatics, and Coloreds.

JOHN RALPH WILLIS, JR.

**ZOMBI** or **ZOMBIE**, zóm'bē, a term, originally from West Africa, with several meanings. In Dahomey and the Congo *zumbi* or *zambi* means "god" or "fetish"; in Haiti and Louisiana the related deity is a python or other snake. A "conjure man" of the Haitian voodoo cult is said to have the power to steal a living man's soul, or to reanimate a corpse; the resulting monster is called a zombi. Emptied of the soul, the carcass may be sold for food; the walking corpse, dead in features and mechanical in action, may be hired out as a drudge. Stabbing the newly dead is a preventive, and feeding salt to the zombi a cure or quietus to the corpse; the former is an obvious precaution like spiking the heart of a Balkan vampire, and the latter may reflect the place of salt in Christian burial and baptismal services.

Though the separable soul is also a European or even universal concept, the details of zombi magic are clearly American importations from Africa. American slang has seized the vivid notion of the walking dead and uses the term to mean either a disagreeable and unwanted human being whom the "ingroup" wishes to ostracize, or a powerful rum drink which threatens to paralyze one's vital spirits.

FRANCIS LEE UTLEY.

**ZONARAS**, zôn'ə-rəs, Joannes, Byzantine theologian and chronicler: fl. 1120. Before 1118 he commanded the imperial bodyguard and was the principal imperial private secretary. Sometime after 1118 he became a monk and turned to literary pursuits. Among his theological treatises is the valuable *Exegēsis tōn hierōn kai theiōn kano-nōn*, an exposition of canon law extracted from apostles, councils, and church fathers. In lexicography he produced *Synagōgē lexeōn syllegetisa ek diaphorōn biblōn*, a lexicon listing obsolete and foreign words with their meanings in contemporary Greek. But his renown rests rather on his *Chronikon* or *Epitomē tōn historion*, in whose 18 books he compiled an annalistic history from the creation of the world to the death (1118) of Emperor Alexius I Comnenus. Its importance is that Zonaras has preserved frequently the very words of authors whose works no longer remain. Thus, for the lost portions of the *Rōmaika* (Roman History) of Dio Cassius (q.v.) we depend upon Zonaras' abstracts entirely for books 1-20 and partially, with Joannes Xiphilinus (q.v.), for books 44-80.

P. R. COLEMAN-NORTON.

**ZONE**, zōn, any encircling line, belt, or boundary, or any division, area, or layer separated from others in some natural or systematic manner. The word is derived from a Greek term for "girdle"; hence, in *mathematics*, a zone is that portion of the surface of a sphere cut off by two parallel planes (see SPHERE), since such a section girdles the sphere. The various *climatic zones* on the earth's surface, as the north temperate and torrid zones (see ZONE, CLIMATIC), are examples of strictly mathematical zones. A mathematical function involving a system of spherical coordinates that divide a sphere into zones is called a *zonal harmonic* (see HARMONIC ANALYSIS, THE—Zonal Harmonics).

From its basic mathematical meaning, the term "zone" has broadened to denote any section or area of the earth clearly marked off from its surroundings, whether the markings are parallel, converging, or even irregular, and whether the area so marked off is large or small. The boundary of any such zone, whether straight, curved, or irregular, is called the *zone line*. Among the most important are the *time zones*, north-south segments on the face of the earth indicating areas in which a fixed standard time is accepted. The boundaries are the converging meridian lines at sea and usually irregular lines on land. Time expressed according to such rules is *zone time*. See also TIME, INTERNATIONAL ZONES OF.

Sometimes an essential part of the definition is that the zone be clearly marked off. Thus, types of soil with clearly visible boundaries between layers (horizons) are classified as *zonal soils*, while others are *intrazonal* or *azonal soils* (see SOIL—Soil Classification). On the other hand, a zone may be as dimly marked off as the kind

used for aircraft guidance, the *equisignal zone*, which is the sector in which distinctive radio signals from two transmitting beacons may be received with equal intensities.

The areas marked off by a zone need not be on the earth itself. They can be under the sea, as the *abyssal* and *littoral zones*, the great depths and the shorelines, respectively. They can be under the earth's surface, as the *Eohippus zone*, which includes the stratum of fossiliferous rock characterized by the remains of *Eohippus*, the early, multitoed horse; or the *zones of rock fracture and flowage*, the latter representing the depths below the surface at which pressure causes rock to flow, rather than fracture. The area can even be in the atmosphere, as is the hollow sphere of the *anacoustic zone*, the atmospheric region above the 100-mile level in which the air is too thin to transmit sound.

The generalization of the term zone has made possible its wide use in many specialized senses. In *anatomy*, it may signify segments cut off by parallel or curved lines, a usage more in accord with the mathematical meaning, as in the three *abdominal zones*. It is also used for the irregular portion of the cerebral cortex that controls the motor nerves, known as the *motor zone* (see MOTOR AREAS). Again, the term may be applied to an entire spherical surface, as in *zona pellucida*, the clear membrane that envelops the ovum. An organism composed of similar segments, such as an earthworm or a centipede, may seem to be divided into zones and to display *zonal symmetry*, and a single segment is sometimes called a *zonite*. In *medicine*, the name *zona* is applied to shingles, or herpes zoster, an inflammatory disease that may encircle the torso like a girdle. The term may even refer to such an immaterial standard as the *comfort zone*, signifying the temperature range in which the human body neither shivers nor sweats.

In *crystallography*, faces parallel to the same edge form a zone, reminiscent of the parallel planes that mark off a zone on the surface of a sphere. The direction of the edge is the *zone axis*, and the poles of the faces parallel to the same edge lie upon a *zone circle*. The various parallel planes are numbered in a conventionally accepted manner, and these numbers, the *zone indices*, are used to characterize the crystal structure by means of a *zone symbol*. The mathematical relation expressing the common position of all the parallel planes with reference to the axes of the crystal is the *zonal equation*. Some crystals are made up of concentric shells of different composition, each following the general form of the crystal. Each of these forms a zone, since the zones of a sphere (in the mathematical sense) can appear as concentric shells or circles in two-dimensional projection. Such crystals are *zoned crystals* and are said to be *zonate* or to have *zonal structure*.

*Electrophoresis* occurs when particles are made to migrate in an electric field from their original positions in a solution or suspension. When the migration is conducted on moist paper from an original narrow zone, the result is a mixture of electrophoresis and chromatography that may be called either *zone electrophoresis* or electrochromatography (see CHROMATOGRAPHY—Partition Chromatography).

In *metallurgy*, an ingot may be refined by melting a narrow zone of its substance and moving this melted zone slowly along the length of

the ingot. Those impurities that are more soluble in the liquid phase of the metal than in the solid are carried along, and those that are less soluble in the liquid are left behind, so that the central portions of the ingot are purified. This is called *zone refining*, while the motion of the molten area is known as *zone travel*. Where molten zones passing back and forth along the ingot are used to render the substance homogeneous by diminishing differences in composition, the process is known as *zone leveling*. Zone melting is also used to purify crystals or to redistribute their impurities.

In *optics*, diffraction patterns are divided into *Fresnel zones*, named for the French physicist, Augustin Jean Fresnel, who analyzed the phenomenon in mathematical detail. A transparent plate, known as a *zone plate*, marked off into a series of concentric zones of fixed widths, with alternate zones blackened, makes use of Fresnel zones to act as a strong focusing device.

For zones in municipal and county planning, see the article ZONING.

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**ZONE, Climatic**, a portion of the earth bounded by parallels of latitude and characterized by a distinctive climate. The torrid zone extends from the equator to the tropics of Cancer and Capricorn at  $23\frac{1}{2}^{\circ}$  north and south latitudes, respectively. The two frigid zones extend from the poles to the Arctic and Antarctic circles at  $66\frac{1}{2}^{\circ}$  north and south latitudes, respectively. Between the frigid and torrid zones lie the north and south temperate zones.

In the torrid zone the midday sun is high above the horizon throughout the year, and the atmosphere receives more heat from the sun than it loses to space by its own radiation. In the frigid zones the radiational cooling of the atmosphere is larger than the meager heating supplied by the sun, which is never far above the horizon and is altogether absent much of the winter. Consequently perpetual warmth bathes the torrid zone while bitter cold in the frigid zones is interrupted only by a brief, mild summer. The extremes of temperature in these two areas are not as great as they might be, for the differences of heating and cooling set the atmosphere in restless motion. The resulting winds transport some of the tropical heat poleward and some of the Arctic and Antarctic cold equatorward across the intervening north and south temperate zones, so that thermal equilibrium is maintained in all the zones. The actual climates of the various zones are therefore determined partly by solar and atmospheric radiation and partly by the modifying effects of air motion.

In the torrid zone, and in the adjacent fringes of the temperate zones, the air flows quite steadily, mainly from east to west. This flow, the trade wind, provides welcome ventilation in a climate that would otherwise be uncomfortably warm and humid. The trade winds of each hemisphere converge gently toward the equatorial region, where compensating upward currents cool to provide extensive cloudiness and heavy rainfall in the moisture-laden air. At the poleward limits of the trade winds, compensating downward air currents inhibit clouds and rain, particularly over the continents, where the great deserts of Africa, Arabia, Australia, and western North America are

found. Here the relentless impact of summer sun on sandy soil produces the world's highest temperatures, while winters are quite cool. Rainfall is so sparse that irrigation is necessary for effective agriculture.

Over the temperate zones the rotation of the earth about its axis becomes effective in creating a different, chaotic regime of winds in which the average air motion is from west to east. Alternating surges of polar and tropical air clash in migratory storms that range as far as the edges of the frigid zones. The resulting climate, in which the most highly developed civilizations have grown, is a changeable and invigorating environment in which the frequent storms ensure abundant rainfall. Within the frigid zones the climate is relatively quiescent, though the effects of storms from the temperate latitudes are felt intermittently. On the perpetual ice sheets of Antarctica and Greenland, temperatures remain below freezing all year and sink in winter to the world's lowest levels.

Striking east-west differences of climate within a zone occur where sectors of continent and ocean alternate. In the north temperate zone, dryness and extremes of summer heat and winter cold characterize the interior portions of Asia and of North America, while relative uniformity of temperature and frequent rain prevail over the oceanic sectors. Southeast Asia, though lying in the latitude of deserts, experiences the world's heaviest rainfall as the steady summer monsoon wind from the adjacent ocean is forced to ascend the massive mountain barriers of that region.

The limits of the climatic zones are not irrevocably fixed. The boundaries oscillate poleward in summer and equatorward in winter. Moreover, evidence of marked climatic variations in the distant past is abundant in the geological record. Proposed explanations of these variations have included expansion and contraction of the zonal climatic boundaries as well as displacement of the poles and drift of the continents.

See also *ANTARCTIC REGIONS—Climate; ARCTIC REGION—Climate; CLIMATE; CLIMATIC HISTORY; CLIMATOLOGY, APPLIED; COMMERCE—2. International Commerce of the World (Natural World Divisions); METEOROLOGY—The General Circulation; TROPICS; WORLD.*

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**ZONING**, zōn'ing, in general, the process of dividing a larger area into smaller units. Hence, in government and business, there is zoning for postal delivery service, for determining attendance at public schools, for setting speed limits on highways, for computing railroad and trucking rates, and for any number of other purposes. In both common and legal usage, however, the term "zoning" by itself has come to refer almost exclusively to the legislative act of dividing a county or municipal unit into districts for the purpose of regulating land use and buildings therein.

Zoning regulations are distinguished from other local ordinances such as building, fire, health, and housing codes. Building and fire codes relate to the manner in which a building is constructed, to assure that it is sound and reasonably safe from accidental fire and other hazards. Health and housing codes relate, in general, to assuring that buildings are maintained according to minimum standards of healthfulness and sani-

tation. Zoning, on the other hand, typically divides all land into several classifications each for residential uses, commercial uses, and industrial uses so that each function of the community will have a proper amount of land in a location suitable to its needs and so placed as to be as compatible as possible with the uses around it. Zoning also controls lot sizes, the bulk and height of buildings, and the setbacks, yards, and open spaces to be established on a lot. This is done in order that the intensity of land use may be controlled to provide certain standards of light, air, and privacy to the occupants, to limit congestion on the streets, and to establish appropriate public services.

**Origins of Zoning.**—Rudimentary forms of zoning may be traced as far back as medieval regulations prohibiting certain activities from taking place within the town wall, and decrees concerning the location of industry were issued by Napoleon Bonaparte in 1810. For practical purposes, however, modern zoning principles were first developed by the Germans Reinhard Baumeister (1833–1917) and Franz Adickes (1846–1915) and generally applied in German cities during the last quarter of the 19th century.

Near the end of the same period, experimentation with zoning began in the United States. Boston limited the heights of all buildings in 1891, and similar restrictions in Washington, D.C., Baltimore, and Indianapolis soon followed. San Francisco enacted an ordinance restricting the location of laundries as early as 1883, and in the period 1909 to 1915 Los Angeles adopted a complex series of land-use measures. The first truly comprehensive and systematic zoning law, however, was the New York City ordinance of 1916. Prepared after more than three years of study by a distinguished commission of civic leaders, it went beyond any previous American or European model and set the basic pattern that has been followed ever since.

The rise of zoning in both Europe and the United States may be attributed in large part to the Industrial Revolution and the rapid growth of cities in the latter half of the 19th century. Prior to this time land and buildings had been controlled by the doctrine of common law nuisance—*sic utere tuo ut alienum non laedas* ("use your property so as not to injure another's"). However, this rough and individualized method of resolving conflicts (which runs back as far as the 13th century in England) appeared less and less adequate as the tempo and intensity of urban life increased.

At first cities reacted by legally prohibiting the worst overbuilding of land, for example, by setting height limits and by limiting the areas in which the most disagreeable industries, such as slaughterhouses and brickworks, could be carried on. However, a number of imaginative persons, particularly in New York City, shortly came to realize that by increasing the predictability of urban land uses and intensities, the zoning device could be a major factor in stabilizing property values and protecting real estate investment. Furthermore, from the city's point of view, a foreknowledge of future uses and building patterns would greatly increase efficiency in the planning, construction, and operation of public services of all types. Through the use of zoning, school, police, fire-fighting, rapid transit, sewer, water main, park, library, and other municipal facilities could be adjusted to the specific needs of the dis-

trict in which they were located. At the same time zoning would provide the working public with more light and air in buildings and lessen congestion in the streets by producing a more rational distribution of traffic-generating functions.

Arguments of this type gave zoning immediate popularity, and it spread very quickly across the United States. By 1926, only 10 years after the first comprehensive ordinance in New York, 30 million Americans were living in communities that had adopted zoning controls. As of 1960, some 2,000 ordinances were in effect, and zoning was being used by 95 percent of all towns and cities over 10,000, as well as by a large percentage of smaller municipal units.

**Legal Basis.**—Zoning ordinances are passed under the authority of the so-called "police power"—one of the great and fundamental attributes of government—commonly defined as the power of the state to act to protect the public health, safety, morals, and general welfare. Unlike the power of eminent domain, the police power may be used to impose restrictions on property without monetary compensation. In the United States the 5th and 14th amendments to the Constitution require, however, that in each exercise of the police power the public good obtained must "outweigh" the private inconvenience or loss incurred.

Since American law had traditionally permitted virtually unrestricted use of land, short of committing nuisance, zoning posed a serious constitutional issue. While most state courts supported the new ordinances, several found them unconstitutional. However, by using analogies from the law of nuisance and other arguments similar to those outlined in the preceding section, the advocates of zoning succeeded in obtaining a definitive approval from the United States Supreme Court in *Village of Euclid v. Ambler Realty Co.* (272 U.S. 365), decided in 1926.

**Zoning and Planning.**—There has often been confusion, even among judges and other public officials, as to the difference between the zoning map and a city master plan (or general plan, as it is often called). The master plan is a general and comprehensive guide to policy for community development for many years into the future. The zoning map and its accompanying text, by contrast, are detailed specific regulations controlling the use of land and the dimensions and location of buildings in the present.

Under sound planning principles, zoning should implement a previously prepared long-range master plan. However, because many municipalities adopted zoning ordinances before the introduction of the master plan concept into the practice of local government, much zoning in the United States is still not properly related to long-range community policies. This situation is now slowly being remedied as more and more municipalities and counties adopt master plans for their future development and revise outdated zoning ordinances in accordance therewith.

**Special Exceptions and Variances.**—The administration of zoning generally includes a zoning board of adjustment (or board of appeals), which has the quasi-judicial function of considering cases of individual hardship. "Special exceptions" are uses or buildings that the ordinance itself specifies may be permitted in a district after review by the board. "Variances" are changes in the actual requirements of the ordinance itself and are to be made by the board only in cases

where there are special conditions and where the strict application of the regulations would result in unnecessary hardship to the landowner. In both cases, the board must act only if it finds that the special exception or variance will not be contrary to the public interest. Some commentators on zoning matters feel that in many cities these procedures have been overused and that board decisions have been insufficiently related to firm policy expressed in a long-range plan.

**Zoning Outside the United States.**—While land-use controls in western Europe are often established in terms of so-called "zones" and regulate many of the same factors as in the United States, many European cities have prepared detailed development plans covering all or parts of their areas which subject the private developer to much more detailed regulation than in the United States. Moreover, since the end of World War II, legislation in some countries transferred land titles in bombed central areas to public ownership. This factor, plus the relatively large proportion of urban housing constructed by public authorities on the Continent, has tended to diminish the importance of zoning controls over private developments.

Prior to 1947, land-use controls in Britain were based on roughly the same principles as American zoning of the same period. However, since the Town and Country Planning Act adopted in that year, every development of land in the United Kingdom must be individually approved by the local planning authority for conformance with an official development plan, a stricter and more specific system than in the United States. Canadian zoning has followed United States practice, although sometimes with greater review at the provincial level than is common at the state level there.

In the historic past, many cities in Latin America, Asia, and Africa have been subjected to rigorous land-use and building controls, often still evident in the older quarters. In more recent times, however, particularly since the end of World War II, extreme population pressures and governmental attention to other matters have caused urban growth on these continents to be virtually unregulated. Individual cities have borrowed American zoning or European types of regulation, but often with only limited success.

**United States Since World War II.**—Since the end of World War II many major American cities have thoroughly revised their zoning regulations. The over-all trend in these revisions has been (1) to increase the specificity of control by increasing the number of district classifications, and (2) to increase the amount of administrative discretion by increasing the number of situations that require approval by the zoning board of adjustment, the planning commission, or other public body.

Recent revisions in zoning regulations have also introduced a number of new devices designed to give the private developer more freedom of action than under the rigid regulations of old ordinances. Among these are: (1) the floor-area ratio, a control governing the ratio of building floor area to total lot area, which permits more variety in the arrangement of building bulk; (2) the open-space ratio, which permits usable open space to be provided where most useful rather than in rigid yard requirements; (3) angle-of-light provisions, which assure light and air with less control on design; and (4) planned-unit pro-

visions, under which both dimensional and use requirements can be relaxed on review by designated public agencies and their approval of a well-considered design for the integrated development of a relatively large area. The last of these has become particularly important in zoning for urban renewal projects.

Reasonable and limited controls over historic parts of a city and the exterior architectural features of private buildings have been recognized in several states, including Wisconsin and Massachusetts. It is possible that this type of control will grow in the future, although the courts will probably be cautious because of the important constitutional issues involved.

In early ordinances, permitted uses were arranged in pyramidal fashion. At the top was the most-restricted residential district. Each successive category of residential, commercial, and industrial district permitted more and more uses, always including those of the preceding district, until the least-restricted industrial district had been reached. Later ordinances, of which the New York City Zoning Resolution of 1960 is a good example, have discarded this concept in favor of permitting "use groups" in each district, based on a careful study of what land uses are functionally related and naturally compatible, regardless of any abstract system of "higher" and "lower" categories. One simple example of this line of thinking has been the exclusion of residential uses from districts for heavy industry, since these functions are almost invariably incompatible.

Related to the use-group concept is the idea of zoning industrial uses according to how they actually perform. Under this system, which is applied in New York, Chicago, and a number of other cities, scientific instruments are used to measure the amount of smoke, dust, noise, odor, heat, glare, vibration, radiation, wastes, traffic, and other possibly objectionable factors that are or may be produced by a proposed industrial plant. Definite standards are then set for performance in each class of industrial district. A specific plant is permitted in a district if it meets the performance standards of that district, regardless of the type of industry that may be involved.

Early zoning legislation permitted uses and buildings established prior to the ordinance to be continued even though "nonconforming." Early zoning leaders expected that the passage of time would gradually eliminate such nonconformities. However, because of the durability of buildings and the economic advantage often accruing to owners from them and their nonconforming uses, natural elimination has been slow. Later ordinances in a number of larger American cities have set time limits on the life of nonconformities, ranging from a few years for uses with minor structures to two decades or more for substantial structures. These ordinances are designed to give the owner a reasonable time to amortize his investment while still assuring an ultimate change to a use or building conforming with the law.

**Current Problems.**—Most authorities agree that one of the most critical defects in American zoning practice has been the failure of many communities to prepare a long-range, comprehensive master plan and to integrate zoning and other land-use controls with it. The modern metropolitan area operates economically as one large community. Politically, however, it is generally divided into dozens or scores of independent municipal units, each having its own zoning power.

The result has often been local zoning patterns that have little relationship to the needs of the metropolitan area as a whole. Many students of this problem are concerned with creating procedures that will ensure some minimum level of metropolitan coordination in zoning while still permitting a maximum degree of local freedom. Another problem is the need for improved administrative procedures. With the increased scope of administrative review and the greater discretion of public officials in contemporary zoning practices, great care must be taken to assure that due process and fair treatment will be afforded to all persons affected.

In the United States, all power to engage in city planning and zoning flows from the state to local governmental units by means of enabling legislation. The enabling legislation of most states is still largely based on the Standard State Zoning Enabling Act and Standard City Planning Enabling Act prepared by the United States Department of Commerce in 1923 and 1927 respectively. This legislation is in need of complete revision, particularly with respect to the problems previously discussed.

Prior to the end of World War II, zoning could be characterized as the most important device available to implement city planning. In recent years, however, its importance has relatively decreased with the elaboration of subdivision regulations providing for review by a public body of the design and layout of new housing areas, and with the establishment of urban renewal procedures to improve the older portions of cities. Zoning does, however, represent a compromise between private rights and the public interest in urban development that has seemed especially congenial to American and Canadian social values. If continually revised to meet new needs and, above all, coordinated with long-range planning, it should continue to play an important role in urban development for many years to come.

See also CITY PLANNING IN THE UNITED STATES.

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**ZOOGEOGRAPHY**, zō-ə-jē-ōg'grā-fē, the science that deals with the distribution of animals over the surface of the earth. In addition to mapping the distribution of animals, it attempts to develop theories to account for the discovered facts. It thus involves a consideration of geological, geographical, and ecological factors and their influences upon animals and their movements.

Few kinds of animals are distributed worldwide; most are restricted to certain geographical areas. Thus each portion of the world has a characteristic fauna that differs from the others in



varying degrees. For example, the animal population of each of the islands of the West Indies differs only slightly from that of any neighboring island, while the animals of the opposite sides of the North American continent, though showing some like characteristics, differ in many respects. Some elements of the fauna of the western United States bear closer relationships to the animal population of Europe than to that of the eastern coast, and the whole of the North American fauna is much more similar to the fauna of Europe than to that of its southern neighbor, South America. The fauna of Australia is, in general, totally unlike that of any other continent, although certain species have relatives in North and South America. Most famous of these are the marsupial opossums of the New World.

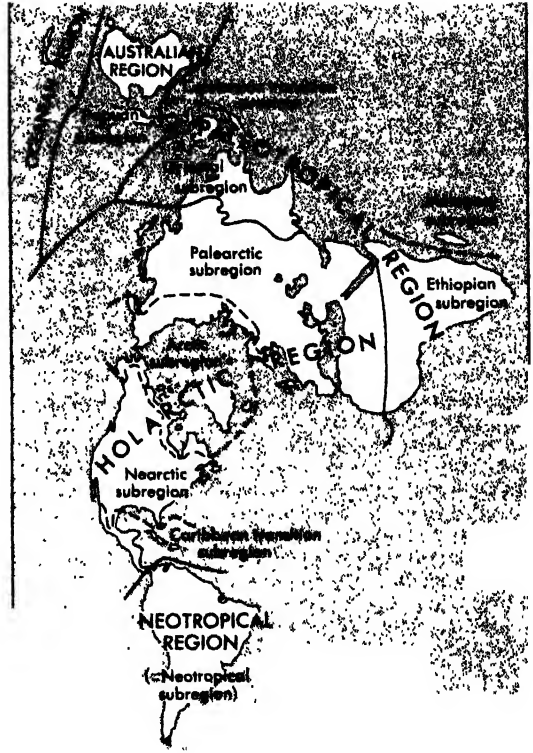
So long as the belief in special creation was adhered to, these facts of distribution presented no problem, but with the development of the concept of evolution they challenged the attention and imagination of biologists. It soon became apparent that related species had common origins and must have dispersed from certain centers.

**History.**—Many early naturalists noted details of animal distribution and were struck by its peculiarities. Voyages such as Capt. James Cook's three-year circumnavigation of the globe (1768–1771) and Matthew Flinders' expedition to Australia (1801–1803) brought back to Europe ample evidence that different regions of the world possessed different faunas. Charles Darwin during the famous voyage of the *Beagle* (1831–1836) collected sufficient zoological materials and observations to enable him later to discuss the facts of animal distribution with authority. This voyage was the impetus for his later development of evolutionary theories that finally enabled scientists to explain some of the peculiar facts of animal distribution. One of the most important ideas in the development of the science of zoogeography was contributed by the 19th century geologist Charles Lyell, who pointed out that the present distribution of animals is conditioned by past changes involving major landmasses.

In 1858 Philip Lutley Sclater attempted to divide the world into zoogeographical regions, basing his work on studies of perching birds. Alfred Russel Wallace expanded Sclater's work in *The Geographical Distribution of Animals* (1876), basing his analysis on mammals. Wallace had worked as a field naturalist in the Malay Archipelago and South America and was impressed with the differences and similarities of these two distinct faunas. In his book, which is still one of the most important volumes on the subject, he divided the world into six zoogeographical regions, which he named Palaearctic, Nearctic, Ethiopian, Oriental, Australian, and Neotropical (see also section *Wallace's Line*). Since his time zoogeographers have been engaged in further studies of the regions, more careful analysis of the fauna, and the incorporation of new geological facts, evolutionary theories, and ecological principles in the interpretation of zoogeographical data.

**Zoogeographical Regions.**—A zoogeographical region is a geographical subdivision of the world that possesses a unique fauna. Based on Sclater's and Wallace's work, the world was divided into zoogeographic regions. This scheme was modified by Karl P. Schmidt in 1954. Schmidt divided the world into three realms: Arctogaeen, Neogaeen, and Notogaeen. The Arctogaeen consists of two

regions: the Holarctic, with the subregions Arctic, Nearctic, Caribbean, and Palearctic; and the Palearctic, with the subregions Oriental, Ethiopian, and Malagasy. The Neogaeen consists of but a single region and subregion, the Neotropical. The Notogaeen is composed of two regions: the Australian, containing the Australian and Papuan subregions; and the Oceanian, which is formed of the New Zealandian, Oceanic, and Antarctic subregions.



Zoogeographical regions of the world, according to Karl P. Schmidt. Each, in general, has a distinct fauna.

These regions are not as distinctive as this listing would imply, for there are always groups of animals whose ranges extend through more than one region. In general, however, each of these areas has a distinct fauna with enough elements peculiar to it to warrant its listing as a zoogeographical region.

Most distinctive of all regions is the Australian which includes Australia and New Guinea. These areas have been isolated from other regions for so long that they have a distinctive fauna. Here are found the monotremes (egg-laying mammals) such as the duckbill; a large and varied assemblage of marsupials; and unusual birds like the emu, lyrebirds, honey eaters (honeyeaters), cockatoos, and the remarkable birds of paradise. The Australian lungfish, distinctive tortoises, and many unique invertebrates also belong to this region.

The Oceanian region includes New Zealand, Antarctica, and the oceanic islands of the Pacific. In New Zealand is found the curious lizardlike *Sphenodon*, only survivor of an ancient group, and the kiwi bird. The oceanic islands of this region are characterized more by the lack of many

groups of animals than by the presence of particular ones. There are, however, many distinctive shore fishes about the islands.

The Neotropical region, consisting of South America, has sloths, anteaters, armadillos, monkeys with prehensile tails, vampire bats, and marmosets. Among the unusual birds are the rheas, toucans, hoatzins, guans, and cassowaries. Many distinctive snakes are found, including boas, anacondas, and tropical pit vipers.

The Oriental subregion of the Paleotropical region includes southern India, southeast Asia, and the Malay Archipelago. It has many distinctive birds including pheasants, babbling thrushes, and barbets. Among the mammals are the Indian elephants, some lemurs, tigers, orangutans, gibbons, and some antelopes.

The Ethiopian subregion of the Paleotropical is formed of Africa south of the Sahara. It contains the aardvark, chimpanzee, gorilla, lion, and many kinds of antelopes. Among the birds are the ostrich and secretary bird. Close to Africa is the Malagasy subregion, consisting of the island of Madagascar and neighboring islands of the Indian Ocean. Madagascar has crayfishes that are lacking in Africa. It also has many different types of lemurs, including the aye-aye, and such unusual birds as the extinct gigantic *Aepyornis*, an ostrich-like bird that may have survived until historic times.

The Palearctic subregion of the Holarctic region consists of Europe, most of Asia, and Africa north of the Sahara. The Nearctic subregion consists of Canada, the United States, and a small portion of Mexico. These two subregions have many faunal elements in common, including distinctive deer, bears, wolves, rodents, and ungulates.

The Caribbean is a transitional subregion between the Holarctic and Neotropical regions. This area of Central America, Mexico, and the Caribbean islands possesses fauna derived from both the other regions as well as some distinctive features. The Arctic subregion is characterized by severe climatic conditions and various circumpolar mammals.

While each region has its unique faunal elements, it also shares other elements with different regions. The boundaries between them are at best hazy and ill defined. Nowhere is the tenuous nature of these boundaries more evident than in the various lines drawn to separate the Australian and Papuan subregions from the Oriental subregion.

See also separate articles on the various continents, countries, and islands mentioned.

**Wallace's Line.**—In 1860 Wallace reported that the western and eastern islands of the Malay Archipelago had faunas more distinct from each other than any other zoological divisions of the earth. He stated that "South America and Africa separated by the Atlantic, do not differ so widely as Asia and Australia." With the limited knowledge of the distribution of animals available during his time, Wallace considered the Strait of Lombok (between Bali and Lombok) as the dividing line between the Oriental and Australian faunas. In 1868 Thomas Henry Huxley called this "Wallace's line." It runs between Bali and Lombok, up through the Makassar Strait between Celebes and Borneo, and then between Mindanao in the Philippines and the Sangi Islands.

After a period of enthusiastic acceptance of this faunal boundary, zoogeographers began to

doubt its validity. Many believed the line to be imaginary; most believed that such a sharp boundary could not be drawn between any two faunal regions. As knowledge increased, Wallace's line was no longer accepted as the boundary between the two regions. That there is a vast difference between the faunas of Bali and Lombok, which are separated by only about 20 miles, or between the rich fauna of Borneo and the relatively poor faunas of the Celebes and the Philippines, cannot be denied. This difference is due, however, to the existence of an impoverished young fauna in one area and an older, richer fauna in the other. Its background can be understood only by a consideration of geological events. Much of the area east of Wallace's line underwent great disturbance in the Tertiary period, and some of the islands did not emerge until the Pleistocene. Thus the western islands represent essentially a continental fauna and the eastern islands an insular one.

Further studies resulted in the establishment (1904) of another line, known as Weber's line, drawn much farther east and based largely on soundings and oceanographic data. In many respects it fits the known zoogeographical picture, with the fauna to the west predominately Oriental and to the east Australian. Many zoogeographers have refused to accept Weber's line and prefer a broad belt as the separation zone. One problem is that if a line is drawn along which there are 50 percent Oriental and 50 percent Australian elements for one group of animals, it may not be the same for another group. This is due in part to the difference in motility of different kinds of animals. The highly motile birds can move more readily to a new landmass than the slowly moving reptiles or many invertebrates. As further evidence of these differences, the flora of New Guinea is largely Oriental, its fauna strictly Australian.

**Dispersal of Animals.**—With the recognition of the principles of evolution, it became evident that various types of animals arose in different areas and spread out from these centers. Because of geological history and geographical location, certain areas have been especially important as centers of origin. In North America, the highlands of Mexico, the Ozark uplift, and the Appalachian Mountains are such centers.

The difference in the ability of animals to move from one area to another makes some better indicators of zoogeographical affinities than others. Many of the smaller freshwater animals such as the protozoans, sponges, rotifers, and some crustaceans have resistant stages or eggs that may be carried from one region to another with ease. They may be blown by the wind, carried on the feet of birds, or transported in many other ways. As a result, many of these species are cosmopolitan in distribution and of little value in zoogeographical studies. At the other extreme are forms such as freshwater fish or earthworms that are quite restricted in their ranges. These cannot stand immersion in salt water, and hence the presence of similar species in two areas is ordinarily indicative of land connections.

Animals with wings such as the birds and some insects are often blown long distances by the wind and dispersed in that way. Reports are frequent of American birds reaching the coasts of Britain and France during heavy storms. Another common method of dispersal is the floating log. Many species of arthropods may cling to such logs as they float out to sea and so are carried long distances.

Speed of dispersal also varies greatly among different animals. Thus the flying birds, bats, and winged insects may spread quickly into a new area while slowly moving terrestrial animals may take years to occupy a new habitat. Even among the latter there are differences. One can scarcely compare the speed of a large mammal or reptile to the slower movements of a salamander or an earthworm.

At any rate, all animals tend to multiply beyond the capacity of their immediate surroundings to support them. As a result, they spread out from these original centers until stopped by some barrier.

**Barriers.**—Barriers to the continued spread of animals are of many different types. Most obvious are definite physical barriers such as oceans, deserts, mountains, or large rivers. Long stretches of ocean, while not a barrier to many birds, may prove absolutely impassable to many mammals, amphibians, freshwater fish, earthworms, and other invertebrates. A desert may stop the spread of many animals dependent upon sufficient moisture, while mountains may be an effective barrier to other forms. Large rivers, while no barrier to large mammals, may be effective barriers to some small species. Climate likewise may limit the distribution of some forms. Most species are physiologically adjusted to certain temperature and humidity ranges, and they can only spread a certain distance until they are stopped by climate extremes outside their range of tolerance. Thus many tropical insects may not be able to move outside the tropical zone or into the cold areas of high mountains because of climatic limitations.

More difficult to measure but nevertheless important are factors that may be termed ecological pressures. If an animal moves into an area already occupied by a similar species having nearly identical food habits and living in a similar habitat, the new animal will probably not be able to survive and occupy the area. The competitive species may prove an effective barrier.

Obstacles that may act as barriers to one kind of animal may prove to be corridors for the migration of another; thus high mountains, while limiting the spread of a tropical form, may be a pathway for an animal living in a cool climate. Many of these problems of dispersal and the effect of barriers may be studied effectively with island faunas.

See also **ECOLOGY**.

**Island Faunas.**—Islands have always been a favorite topic for students of evolution and animal distribution. In general an island is one of two types: continental or oceanic. Continental islands are located near larger continental masses of which they were once a part. They usually have a rich, balanced fauna resembling the neighboring landmass. Frequently they have many species in common with the nearby continent, and the unique species are usually closely related. Examples of continental islands are Great Britain and the small islands off the California coast.

Oceanic islands, on the other hand, arise independently of continents. The volcanic and coral islands of Polynesia are examples of this type. Their faunas are derived from forms that arrived accidentally, found conditions suitable, and then became established. Thus we find that many of these islands lack a mammal fauna or have only bats, and usually have a number of species of oceanic birds and only a limited assortment of insects. The fauna is commonly poor and distinctly

unbalanced as compared to continents. The island of St. Helena, about 1,200 miles from Africa and even farther from South America, originally possessed no native vertebrate fauna but had 129 species of beetles, all but one unique.

Because of their isolation, many islands lack large predators. This has enabled unique species to develop that could not have survived on a continent. These include such forms as the dodo of Mauritius in the Indian Ocean and the solitaire of nearby Rodrigues, both large, flightless, clumsy birds, now extinct.

**Historical Factors.**—Many facts of the present-day distribution of animals are explicable only by reference to past geological history. For example, the zoogeographer wants to know why tapirs are found in both tropical America and the Malayan region, marsupials in both America and the Australian region, and camels in Asia and the Andes. Obviously such discontinuous distribution cannot be explained satisfactorily by looking at the present-day formation of continents and oceans. Instead, zoogeographers must turn to a study of fossil remains and geological history.

Since discovered fossils and much crucial geological information are still fragmentary, different interpretations have been given to the available facts. One large group of zoogeographers believes that through most of that part of geological history when life has been present, the continents and oceans have been essentially the same as they are today. Peculiar relationships and distribution are explained by various dispersal methods, such as wind. This school of thought is willing to admit, however, that at times in the past there were various land bridges for dispersal, including connections from present-day Alaska to Asia over what is now the Bering Strait, connections in the north between North America and Europe, and a land link between Asia and Australia. Certainly it is known that various parts of land are often submerged, rise again, and then sink. One example is the Central American land bridge, certain portions of which, in past ages, sank repeatedly below the sea to rise again later. The opening and closing of this bridge had its influence on the migrations of animals between the two American continents.

Another group of zoogeographers has postulated more extensive and numerous land bridges to account for the distribution patterns. Still another group believes that at one time, about the Late Paleozoic era, the continents were all united and that this single landmass fragmented into the present-day continents, which then drifted to their present positions; this is known as the "continental drift" theory. While proponents of these various theories support them vigorously, more geological and zoogeographical investigation will have to be made before definite conclusions can be reached.

See also **LAND BRIDGES ACROSS THE OCEANS**; **PALEOGEOGRAPHY**.

**Zoogeography of the Sea.**—While most zoogeographical principles have been based on terrestrial and freshwater studies, the sea too has been investigated. In many ways, the knowledge of ocean animals is more limited than that of terrestrial ones. This, together with some unique problems of the sea, has tended to make it more difficult to divide the ocean into zoogeographical regions. For one thing, unlike the land, the oceans are continuous throughout the world. Thus some larger marine animals such as whales may range

over the entire world. Also many invertebrates that are sessile or slow moving as adults may have pelagic larvae that are carried by waves and currents for many miles; these include such animals as worms, echinoderms, sponges, and mollusks. As a result, some species are widely distributed and may be found in many regions of the world where ecological conditions are favorable. Thus the presence or absence in a given area of any one animal may be more dependent on local ecological factors than on historical zoogeography.

In spite of these difficulties, zoogeographical regions are found to be recognizable in the ocean. In fact, studies made on marine faunas have at times helped to shed light on terrestrial problems. Certain tropical shore fishes on the Atlantic side of Central America closely resemble others on the Pacific side. This resemblance can be accounted for only on the basis of breaks in the Central American corridor in previous geological periods.

See also FISH—*Distribution and Habitat*; MARINE BIOLOGY.

**Influence of Man.** As humans have spread over the earth, they have transported many animals with them. Some, such as pigs, dogs, and goats, have been carried deliberately; others, such as rats, mice, cockroaches, bedbugs, and fleas, have been brought along unknowingly. Even primitive man played a small part in transporting animals. When the first white men visited Australia, they found a dog, the dingo, whose ancestors had been brought in by the aborigines, and pigs were transported to the Solomon and New Hebrides islands by the natives.

Sometimes human introduction of animals has so upset the balance that natural forms have

been destroyed. This is especially apparent on islands, where the unwitting introduction of rats has at times completely killed off the native birds by destroying their eggs and young. Goats left on islands by mariners have multiplied and destroyed the vegetation, so that the native fauna dependent on the vegetation has disappeared.

With the advent of rapid transportation and extensive commerce in modern times, the introduction of animals to new localities has become more frequent. Many insects, birds, rodents, and other animals have been introduced into new lands; frequently these new forms have caused disturbance of the native biota.

See also ANTARCTICA—*Plants and Animals*; ARCTIC—*Flora and Fauna*; BIRD—*Distribution*; MAMMAL—*Geographic Distribution*; TROPICS—3. *Animal Life*; WORLD—*Biological Environment* (Fauna).

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**ZOOLOGICAL GARDENS**, zō-ə-lōj'ī-kəl gār'dənz, gardens or parks where wild animals are exhibited and studied. The relationship between man and animals that finds expression in the modern zoological garden (or zoological park, as it is more commonly called in the United States) dates approximately from the 18th century. Its essence is an interest in wild animals not only as

The Bronx Zoo, in New York City, pioneered in providing natural surroundings and greater liberty for its animals.

SCHWIMMER/BRUCE COLEMAN





K. W. FINK/BRUCE COLEMAN

The San Diego Zoo, one of the largest zoos in the world, is a model of how animals should be presented to the public.

captive curiosities, but for their own sakes: for the role they play in the economy of nature; for the study of comparative anatomy and behavior; and for aesthetic and cultural reasons.

**History and Extent.** The earliest approach to a modern zoo was the Park of Intelligence created by a Chinese ruler about 1150 B.C. in the province of Honan and maintained for several hundred years thereafter; mammals, birds, turtles, and fish were kept under natural conditions. The ancient Egyptians, Assyrians, and Babylonians also kept wild animals, primarily to enhance the glory of their rulers; and large numbers of animals were imported by the Romans for combats between man and beast, or beast and beast, in the arena. In the Middle Ages, lions, monkeys, peacocks, and similar exotic fauna were exchanged as presents between the rulers of states. These collections, furnishing a ready supply of animals for hunting or kept for reasons of prestige, led insensibly to the establishment of royal or public menageries on a more or less permanent basis in many parts of Europe. As the scientific spirit of inquiry developed in the 18th and early 19th centuries, the menageries lay ready to hand for the work of such celebrated naturalists as the comte de Buffon, Georges Cuvier, and the chevalier de Lamarck.

The great early collections of wild animals were connected for the most part with courts or cities in the Old World, but the New World had its counterpart under the Aztec ruler Montezuma, who built enormous installations for mammals, birds, reptiles, and fishes and employed specialists to catch and breed animals for his collection and to look after their health. The collection was destroyed by Hernán Cortés in 1521.

The United States was comparatively late in showing an interest in animals, other than as a source of food or sport, or to cater to idle curiosity in the exhibitions of traveling showmen. The

first zoological garden in the United States was opened in Philadelphia in 1859. The country has since made up for its slow start and now has more than twice as many recognized zoos as any country in the world. According to the *International Zoo Yearbook*, published by the Zoological Society of London, there are more than 400 zoos in the world; countries noted for their numerous zoos include the United States, East and West Germany, Japan, Britain, Soviet Union, Czechoslovakia, Poland, India, and the republic of Ireland.

Besides the zoos that enjoy municipal or county support and are tax exempt, there are in the United States innumerable "roadside zoos," game farms, private menageries, and circus collections of wild animals. "Going to the zoo" has become a major American form of recreation. Reported world attendance at zoological gardens is about 200 million, of which United States zoos account for 50 million.

**Methods of Presentation.** Concepts of how animals should be presented to the public in a zoological garden are constantly changing in the direction of more natural surroundings and greater liberty for the animals, and special exhibits or situations are created to demonstrate the animals' normal way of life. The trend away from restraining bars began in Germany at the end of the 19th century, and the moated or barless enclosure is now commonplace. It has been found that even free-flying birds can be controlled within exhibition buildings, without restraining wire mesh or glass. Typical examples are at the St. Louis and Philadelphia zoos, where the exhibits are heavily planted, providing concealment and perches. The public space beyond is comparatively bare of these so that the birds tend to stay in the habitat exhibit.

Elsewhere, "walk through" exhibits of birds introduce the visitor into the birds' habitat, as in





ZOOLOGICAL SOCIETY OF SAN DIEGO

An animal health technician uses a blowgun to vaccinate a Przhevalsky's horse against tetanus.

the San Diego zoo, where visitors may stroll through a screened tropical rain forest exhibit containing hundreds of birds. Since the screened area is comparatively large—170 feet long, 80 feet wide, and 90 feet high—and contains many large trees, the birds are essentially at liberty to lead lives as in nature. The endeavor in such installations is to display the animal against its own background insofar as possible, so that the visitor carries away an understanding of its way of life rather than a mere impression of form or color.

Mammals also lend themselves to ingenious and modern methods of display. An example is the reversal of the day-night cycle in nocturnal mammals accomplished in the New York Zoological Park. Small mammals seldom seen by zoo visitors except as curled-up balls of fur have been induced to be active by day and to sleep at night by bathing them in red fluorescent light from 11 A.M. to 11 P.M. and in white light for the remainder of the 24-hour period. Because of the structure of the eyes of night-active animals, the red light is "invisible" light to them, and they readily wake up and begin feeding and prowling when the red light comes on, and just as promptly go to sleep under white light. Flying squirrels, night monkeys, pottos, galagos, kinkajous, and similar nocturnal mammals respond quickly to the red-light routine, becoming adjusted usually within a week.

**Role in Conservation.** The major zoological gardens of the world are playing an increasingly important part in the conservation of wild animals, in the preservation of rare species, and in

the protection of animal health. Père David's deer, Przhevalsky's (Prijevalsky's) horse, the wisent, and the nene or Hawaiian goose, to name but a few, would be extinct today if it were not for the breeding and protection encouraged or otherwise fostered by zoos. On the broad front of wildlife conservation, the New York Zoological Society, which operates the New York Zoological Park, has taken leadership in America in the conservation of threatened species, particularly in Africa, the American West, and Alaska. The need for wildlife protection in Africa became acute with the withdrawal of the colonial powers, and through a special fund the New York Zoological Society has made ecological surveys, trained Africans in conservation, drilled wells in drought-stricken areas, and aided in the enforcement of anti-poaching laws.

Through cooperative efforts by zoological parks, increasing numbers of rare animals are being bred in the United States. This has been accomplished by the practice of "pairing up" single animals in different zoos, the resulting offspring being divided among the participants and other interested zoos.

**Protection of Health.** Major zoological parks in the United States maintain full-time veterinarians to safeguard the health of the collections, and in the larger cities the zoo veterinarian usually has close liaison with pathologists and technicians in the local hospitals. These specialists may work directly with the veterinarians when a difficult or especially interesting case arises, and in turn the zoo's collection is a ready source of animal tissue for research studies by zoologists,



ZOOLOGICAL SOCIETY OF SAN DIEGO

A newly acquired rhinoceros, an endangered species, is carefully released into the park at the San Diego Zoo.



Above ZOOLOGICAL SOCIETY OF SAN DIEGO

(Above) Increasing numbers of rare animals, such as the okapi, are being successfully bred in captivity. (Below) A zoo keeper marks ostrich eggs for the incubator.

Below ZOOLOGICAL SOCIETY OF SAN DIEGO

anatomists and pathologists. The usefulness of many zoo animals does not end with their death; the blood, heart, lungs, liver, brain, and other organs may be distributed to specialists whose requirements are on file with the veterinarian.

Zoo experimentation has been important in the development of various types of guns and pistols that fire syringe cartridges loaded with drugs, anesthetics, or tranquilizers, making it possible to immobilize and treat many animals that previously could not be restrained or could be held for treatment only after violent and dangerous struggles. These syringe-firing devices have also been used with success in the field, particularly in game-tagging studies in the American West and in Africa.

**Acquisition.** There are six ways by which zoological gardens acquire their animals: by birth in the collection; purchase; gift; exchange with other zoos; direct collecting on expeditions; and by the voluntary action of animals that fly or wander into the zoo grounds. The world-wide network of airways has made access to the homes of exotic fauna so easy and transportation back to the zoo so fast the zoological gardens are fast approaching the end of the more spectacular "never before exhibited" animals. It has been estimated that there are about 3,200 kinds of mammals in the world today, 8,600 birds, and 6,000 kinds of reptiles and amphibians. While very few zoological gardens have ever exhibited more than 1,000 kinds of animals in a given year, over the years almost all of the known, really spectacular animals have been exhibited in one zoo or another. The future may not see many



"new" animals in zoological gardens, but it will certainly see them exhibited more naturally and more meaningfully.

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Society.

**ZOOLOGY**, zō-ōl'a-jē, the science that deals with animals. In the present article, the subject is discussed under the following main headings:

- |                 |                         |
|-----------------|-------------------------|
| 1. Subdivisions | 3. Groups of Animals    |
| 2. History      | 4. Evolutionary Zoology |
|                 | 5. Bibliography         |

### 1. Subdivisions

Animals and groups of animals have many properties; hence zoology has a number of subdivisions. These subdivisions, in turn, do not find their limits within zoology but are part of the broader subject of biology, since many of the properties of animals are possessed in common with other living things. Genetics, for example, embodies concepts that apply alike to microorganisms, plants, and animals. Yet a study of the genetics of bacteria is, properly speaking, microbiology; a study of the genetics of corn is botany; and a study of the genetics of the fruit fly or of man is zoology.

The aim of zoology is to understand the lives of animals. By animal life is meant the sum total of all of the properties of animals and animal populations. For this reason the subdivisions of zoology overlap one another and serve, only in the roughest way, to classify the activities of zoologists. The physiologist, for instance, may study the function of the kidney, but in doing so he cannot ignore its structure, which is the proper sphere of study for the anatomist. There is, however, general agreement about the major subdivisions. *Morphology* or *anatomy* deals with the form and structure of animals. Studies of this kind may be carried out at a gross or at a microscopic level. In the latter case the investigation may be of groups of cells and be known as *histology* or may concern the structure of the cell itself, in which event it is called *cytology*. *Physiology* is concerned with function and behavior, with the mechanism of whatever processes can be recognized in animals. A physiological analysis often proceeds to a chemical or physical level. Investigations of behavior may sometimes properly be termed *psychology*. *Embryology* is the science of the development of individuals and may be anatomical, physiological, biochemical, or genetic. *Genetics* is the study of heredity and deals with the nature of hereditary determinants, their synthesis, mutability, and mode of action, and the way in which characters are passed from individual to individual and, in populations, from generation to generation. *Taxonomy* or *systematics* deals with the classification of animals, their nomenclature, and their family relationships. The study of fossil forms from all points of view is *paleontology*. *Ecology* takes up the relationships existing among animals and between animals and other organisms and their environment. So defined it includes *parasitology*, or the study of animals that live at the expense of other organisms.

During the 19th century the whole of zoology was unified by the theory of evolution. This conception allowed an understanding of how the various kinds of animals of present times,

with their structures, functions, and interrelationships, may have come about, and offered an explanation of the patterns of similarity. Since the emergence of evolutionary theory, a main objective of zoologists has been not only to study how animals maintain themselves, reproduce, and develop, but to analyze the historical or evolutionary background of such existing systems. Initially studies on evolution were descriptive and used the observational approach. Especially when such studies involved living animals in their usual habitats, they were considered a part of "natural history." Although natural historical investigations continue and have scientific worth and an aesthetic value of their own, the beginning of the 20th century saw an upsurge of a special type of experimental investigation. Such investigations often utilize chemical, physical, and mathematical methods and are usually referred to under the headings of *biochemistry*, *biophysics*, and *biometrics*. These subjects also overlap among themselves and with those already mentioned; there is a biochemistry of development just as there is a biochemistry of muscle function.

The subject matter of zoology is also divisible in terms of the animals being studied. For example, *vertebrate zoology* is the study of animals with backbones; *invertebrate zoology*, the study of the remainder of the animal kingdom; *ornithology*, the study of birds; *protozoology*, the study of protozoa. It is sometimes hard to decide whether a protozoan belongs to the animal kingdom, the difficulty residing in the fact that plants and animals were first defined at a time when microorganisms were unknown. Perhaps it is preferable to relegate the protozoa and the protophyta to a separate kingdom, Protista (or Protoctista). Both botanists and zoologists, however, consider these organisms their legitimate subject material.

See also ANATOMY; ANATOMY, COMPARATIVE; ANIMAL PSYCHOLOGY; BIOCHEMISTRY; BIOLOGY; CYTOLOGY; ECOLOGY; EMBRYOLOGY; ENTOMOLOGY AND INSECT CLASSIFICATION; GENETICS; HERPETOLOGY; HISTOLOGY; MARINE BIOLOGY; ORNITHOLOGY; PALEONTOLOGY; PARASITES; PHYSIOLOGY.

### 2. History

**Antiquity and Early Modern Period.**—The first attempt at a comprehensive classification of animals and their properties was made by Aristotle (384–322 B.C.). Classical antiquity saw many other efforts, the major one probably being the voluminous work on natural history by Pliny the Elder (23–79 A.D.). Galen (129/130–199/200 A.D.) was another early authority of great influence. He dissected animals for his works on human anatomy, which were in standard use in medicine throughout the Middle Ages. During the Renaissance, Konrad Gesner (1516–1565) compiled an encyclopedic natural history that was characterized by an attitude of scientific skepticism. Leonardo da Vinci (1452–1519) and Andreas Vesalius (1514–1564), imbued with the new spirit of investigation, accumulated through dissection a knowledge of human anatomy far more exact than that which had hitherto existed. The ideas of Francis Bacon (1561–1626) spread in the 17th century, and an increasing emphasis was placed on direct observation and experiment.

One of the most successful users of the ex-

perimental method was William Harvey (1578-1657), who demonstrated the circulation of the blood and the function of the heart, arteries, and veins. The invention of the microscope introduced a series of investigations into the fine structure of animals especially by such men as Anton van Leeuwenhoek (1632-1723), Jan Swammerdam (1637-1680), and Marcello Malpighi (1628-1694), who discovered capillary circulation. The researches of Caspar Friedrich Wolff (1733-1794) in embryology established the fact that the organs of the embryo develop from the relatively indifferent material of the egg and are not preformed in an infinite series. Lazzaro Spallanzani (1729-1799) experimented on spontaneous generation and correctly recognized the basic continuity of life.

**Taxonomy and Morphology.**—A real advance in the classification of animals was made by John Ray (1627-1705), who was consistent in employing structural similarity as a criterion. His work was brought to a culmination by Carl Linnaeus (1707-1778), who introduced the binomial system of nomenclature (genus and species, as in *Homo sapiens*) and whose *Systema naturae* (1735) marks the beginning of the modern system of classification. Comparative anatomy and natural history developed rapidly during the 18th century under the impetus of such scholars as the comte de Buffon (1707-1788) and Johann Wolfgang von Goethe (1749-1832). The fact of evolution became clear to Erasmus Darwin (1731-1802), the chevalier de Lamarck (1744-1829), and others who believed, but could not experimentally demonstrate, that evolution occurred by the inheritance of characters acquired through use or disuse. The great French tradition was carried forward by Georges Cuvier (1769-1832), who extended his morphological studies to fossil forms. Investigations that were to help make Germany the center of zoological research in the 19th century were carried out especially by Karl Ernst von Baer (1792-1876) in comparative embryology and by Karl Gegenbaur (1826-1903) in comparative anatomy.

**Evolution and Experimental Research.**—The seeds of evolutionary theory were nourished by the explorations and collections of great naturalists such as Alexander von Humboldt (1769-1859) and by demonstration of the principles of geological succession by Charles Lyell (1797-1875). In the intellectual climate thus created, Alfred R. Wallace (1823-1913) and Charles Darwin (1809-1882), themselves competent and traveled naturalists, simultaneously in 1858 proposed theories of evolution based on natural selection. The impact on zoology and other fields of learning was immediate and explosive. General acceptance of the new interpretation was not equally rapid; for example, Richard Owen (1804-1892) in England and Louis Agassiz (1807-1873) in America, whose researches in comparative anatomy and paleontology were later to be of great value to evolutionary theory, rejected it. Nonetheless, an intensive period of research into the course of evolution ensued; the great popularizers of this knowledge were Herbert Spencer (1820-1903), Ernst Haeckel (1834-1919), and Thomas H. Huxley (1825-1895). The new spirit spread, and vigorous programs in paleontology were initiated in Europe and in the rich collecting areas of western America.

Although the evolutionists of this period were satisfied to explain things in terms of their historical origin, a new group of workers demanded answers in terms of mechanism. For example, in embryology, the comparative approach was amplified by an experimental one, especially through the efforts of Wilhelm His (1831-1904), Wilhelm Roux (1850-1924), and Hans Spemann (1869-1941). This experimental philosophy was vigorously applied to other fields of zoology throughout the 19th century. Friedrich Wöhler (1800-1882) in synthesizing urea showed that organic compounds, previously found only in association with living organisms, could be made in the laboratory; thus they were stripped of their aura of mystery. Johannes Müller (1801-1858), Hermann von Helmholtz (1821-1894), and Claude Bernard (1813-1878), conducted their physiological researches in a similar spirit.

**Cytology and Genetics.**—The role of the cell as a unit of structure was recognized as early as 1838 by Matthias Schleiden (1804-1881) and Theodor Schwann (1810-1882), and detailed investigations into cell division, including the behavior of chromosomes, were conducted by Karl von Nägeli (1817-1891) and Eduard Strasburger (1844-1912). During this era Rudolf Virchow (1821-1902) established the science of cellular pathology. The role of the nucleus in fertilization, cell division, and sex determination progressively came to be understood through the efforts of Oskar Hertwig (1849-1922) and his brother Richard von Hertwig (1850-1937), Walther Flemming (1843-1905), Otto Bütschli (1848-1920), Edouard van Beneden (1846-1910), Theodor Boveri (1862-1915), and Edmund B. Wilson (1856-1939). August Weismann (1834-1914) combined this new cytological knowledge into a comprehensive theory of heredity and evolution based upon natural selection and emphasized the continuity and independence of the germ plasm. Other important students of heredity and evolution included Francis Galton (1822-1911), who introduced statistical methods to the field, and Wilhelm Ludwig Johannsen (1857-1927), who clearly distinguished the hereditary composition (genotype) from the observable characters (phenotype) of an individual. A major advance in the study of inheritance came with the rediscovery in 1900 of the laws first recognized by Gregor Mendel (1822-1884) about 1865. These laws were further developed by Hugo De Vries (1848-1935), William Bateson (1861-1926), and Thomas Hunt Morgan (1866-1945) and his school, who, among other things, were able to show that the bulk of the hereditary units were aggregated in the chromosomes. The generalizations of Mendelian genetics offer the broadest opportunities for the accurate prediction of biological events. In this way they approach the laws of the more highly developed physical sciences.

Although the names of individuals have been singled out for mention, it should be understood that zoology, like every other branch of knowledge, has grown through the concerted efforts of multitudes of unmentioned investigators, some of whose contributions may have been as great as those of the zoologists named.

**Present Orientation.**—In general, it can be stated that until the 20th century a strong emphasis was placed on differences in structure and

function. Hence botany, zoology, microbiology, and subdivisions within these fields followed relatively separate developments. With the progressive accumulation of knowledge, especially in cytology, genetics, and biochemistry, the 20th century has seen a reversal of this emphasis. The fundamental similarity of all living things is now apparent, and information secured about animals is often directly transferable to plants and vice versa. Of course there are differences, but in order to be alive, to maintain life, and to reproduce, certain common features are required.

See also biographies of individual scientists.

### 3. Groups of Animals

Animals inhabit almost all parts of the earth from the equator to the poles, from the depths of the oceans to high mountain summits. They have invaded the soil, the water, and the air and have even become adapted to live within other organisms. Accordingly their diversification of form and function is great. About 800,000 different species of animals have been recognized, and it is estimated that the total number might exceed 1,500,000.

**Classification.**—A species is a group of similar animals which ordinarily interbreed with one another and not with others. Similar species are grouped in a genus and similar genera in a family. Higher categories include, in turn, orders, classes, and, finally, phyla, which are the major subdivisions of a kingdom. There is not always universal accord among zoologists as to whether a group of animals should be considered in one or more species, and similar difficulties are encountered with higher categories; this is a consequence of the fact that the array of animal life reflects the fundamental relationship of forms that have evolved with modification from common ancestors. Nevertheless, a generally satisfactory listing of the major groups of animals is as follows:

Kingdom: Animalia

Phylum: Protozoa	Echiuroidea
Mesozoa	Annelida
Porifera	Arthropoda
Coelenterata	Mollusca
Ctenophora	Entoprocta
Platyhelminthes	Bryozoa
Nemertinea	Phoronidea
Nematoda	Brachiopoda
Rotifera	Chaetognatha
Sipunculoidea	Echinodermata
Priapulida	Chordata

See also ANIMAL; ANIMAL CLASSIFICATION.

**Protozoa.**—The Protozoa are distinguished by the fact that their bodies are unicellular. Nevertheless, they can be exceedingly complex in structure. This is not surprising when one reflects that their microscopic bodies are adapted to carry out all of life's functions. Their organs, such as the locomotor apparatus, food canal, and nervous and excretory systems, are differentiations of their protoplasm and not, as in other animals, composed of cells, each with its own nucleus. There is a nucleus in the protozoan body (sometimes there are several), and its experimental removal and transplantation have demonstrated that it is required for the continued normal function of the protoplasm. In asexual reproduction the nucleus divides as does that of the cells of metazoa (animals whose bodies are composed of cells). Some protozoa undergo sexual reproduction, and when they do so, nuclear changes take place that are not unlike those occurring in the formation of sperm

and eggs and in fertilization of metazoa. As a consequence, inheritance in protozoa is fundamentally like that in metazoa, for in both cases the majority of the hereditary factors or genes are on the chromosomes of the nucleus. Protozoa have been shown, in some cases, to require the same types of food as man, that is, amino acids, vitamins, and minerals. In fact, the chemistry by which they secure building material and energy from proteins, carbohydrates, and fats is not fundamentally different from that of other organisms.

Undoubtedly one of the earliest states of life on earth consisted of animals built on the protozoan plan. From the Proterozoic era (perhaps a billion years ago) onward the protozoa have retained this basic plan while modifying it in some respects. In this group there are forms that possess chlorophyll and manufacture their own food from carbon dioxide and water with the energy of sunlight. But even this does not make us sure that they are plants, for under certain conditions they can be made to lose their chlorophyll, and provided they are given certain foods, they move about and reproduce like other protozoa. Nevertheless, it seems certain that the plants in evolution arose from green flagellates. Some protozoa live in aggregations, suggesting that from similar aggregates the many-celled plants and animals arose long ago. Others are shelled forms, such as the foraminifera and radiolaria, especially prolific in the seas, where their skeletons fall in a constant rain to the ocean floor. In the past similar deposits have been transformed into stone, and since the populations of shelled protozoa varied with time, the microscopic analysis of shale containing protozoan skeletons is a guide to geologists in their search for oil. The largest of these shelled protozoa is a fossil form that was sometimes more than an inch in diameter. Many protozoa have complex life cycles and are parasitic in other organisms. *Plasmodium*, which causes human malaria, passes part of its life in the body of a mosquito.

See also PROTOZOA.

**Mesozoa and Porifera.**—The bodies of unicellular organisms are nearly always small while the metazoa, or many-celled animals, may grow large. Whenever size is great, the problem of transport of food, waste products, and oxygen in and out of the depths of the body becomes increasingly difficult. This problem arises because as size increases, there is a proportionately greater increase of volume than of surface. The metazoa solve this problem either by forming thin-branched colonies, or by developing enlarged body cavities, or systems of circulatory vessels. They must also, in growing large, develop some type of skeletal support.

To the phylum Mesozoa belong some microscopic parasitic animals that are interesting phylogenetically because of the primitive aggregation of their cells into a solid body consisting of two layers.

The Porifera or sponges, like the Mesozoa, possess bodies with two layers of cells, but some relatively unorganized cells are located in between. This organization is in fact so plastic that when the cells of a sponge are separated by being squeezed through fine cloth, they are able to aggregate to form a new sponge. The body of a sponge is riddled with numerous canals lined by flagellated cells which create a current



of water and ingest food particles thus carried in. As sponges increase in size, many of them form spicules in the middle layer that afford a type of skeletal support. The siliceous spicules of some fossil sponges form a rock known as flint. See also SPONGES.

**Coelenterata and Ctenophora.**—The Coelenterata, or jellyfish, anemones, and corals, have a better-developed middle layer. They have a mouth but no anus, waste material being ejected through the same opening it entered as food. Some forms increase in size by branching, the result being a colony of zooids connected by a series of stems through which the gut passes. Such polyps or hydroids may have an alternation of generations whereby a jellyfish stage is budded off. These free-swimming medusae form eggs and sperm, and the fertilized eggs develop once again into hydroids. Some jellyfish have lost the hydroid generation, and their fertilized eggs develop directly into medusae again, while others have only the hydroid stage. Food and oxygen are brought into the thick bodies of jellyfish by canals. Some of these forms possess special stinging cells that are dangerous even for man. Although sea anemones may also become large, their bodies are relatively thin walled, and the gut is divided by septa. The corals are mostly colonial sea anemones that secrete different sorts of skeletons. They are exclusively marine and sometimes form massive coral reefs and coral atolls, as in the Pacific Ocean. Much limestone is composed of fossil coral. All of the Coelenterata have bodies that are symmetrical around a central axis. This is called radial symmetry and is also characteristic of the phylum Ctenophora, or comb jellies. The latter forms are constructed somewhat like the Coelenterata but have eight rows of paddlelike plates by means of which they swim. Many of them can carry out chemical reactions that produce light and so are the source of bioluminescence when the sea is disturbed on a summer night. See also COELENTERATA; CORAL AND CORAL REEFS; JELLYFISH; SEA ANEMONE.

**Platyhelminthes and Other Worm Phyla.**—The remaining animals are bilaterally symmetrical or have evolved from such forms. Bilateral symmetry means that the halves of the body are essentially mirror images of one another. Most primitive is the phylum Platyhelminthes, which includes free-living flatworms and the parasitic flukes and tapeworms. When a gut is present, it is a blind sac opening only through the mouth. The middle layer or mesoderm is well developed, and there is a system of excretory canals whose fluid contents are agitated by cells possessing a motile bundle of fibers. There is also a well-developed nervous system with some centralization in a ganglion at the head. The Platyhelminthes are usually hermaphroditic. The free-living forms, like *Planaria*, have considerable regenerative power; whole animals can be re-formed from small parts. They can also shrink to a small fraction of their original size when starved. The parasitic forms ordinarily have complex life cycles that sometimes involve several intermediate hosts. They are of great medical importance, especially in tropical regions. The Nemertinea, or nemertean worms, are in some respects like the Platyhelminthes, but they have an anus, an eversible proboscis, and a rudimentary circulatory system. See also PLATYHELMINTHES.

The Nematoda consist of the free-living and parasitic roundworms, and the Rotifera comprise the rotifers or "wheel animalcules." The nematodes are of great medical importance, causing such diseases as hookworm and elephantiasis. The Sipunculoidea, Priapulida, and Echiuroidea are worms related to the segmented Annelida. One of the echiuroids shows an unusually plastic mode of sex determination. The larva, if attracted to and settled on a female, develops into a male. If, however, it settles free on the ocean bottom, it differentiates into a female. The Annelida, a group that includes the earthworm and the leech, have contractile blood vessels and well-formed body cavities from which the excretory organs lead as tubes to the outside. Most of the structures of the body, such as the appendages, muscles, excretory organs, ganglia on the nerve cord and lateral nerves, and blood vessels, occur in a repeated pattern along its length. This segmentation, commonly called serial homology, is not present in the early embryo, such as the ciliated larva of marine annelids, but posterior segments are added during growth. See also ANNELIDA; EARTHWORM; NEMATODA; ROTIFERA.

**Arthropoda.**—The Annelida are believed to be related to the Arthropoda through the existence of an intermediate primitive form known as *Peripatus*. All of these forms are also similar in a number of embryological ways. To the arthropods, or joint-legged animals, belong the crabs, shrimps, barnacles, centipedes, insects, scorpions, spiders, and others that have been so successful in their invasion of the land, sea, and air. All possess a horny exoskeleton of chitin and, like the annelids, are segmented. The appendages occur as a pair per segment and vary in number among the different groups; they may be modified into walking, swimming, or flying structures and, on the anterior segments of the body, become mouth parts. The aquatic crustacea breathe by means of gills, but land forms such as the insects have a special system of branched tubes (tracheae) that lead air into the deepest tissues. The structure of these animals is extremely complex: the circulatory system may possess a heart; there are glands controlling color, molting, metamorphosis, and other functions; the nervous system is highly organized; and there are specialized sense organs such as compound eyes. This complexity of structure is reflected in the behavior of the arthropods, and some groups of insects like the ants and bees have evolved a highly integrated social life. Arthropods are both very useful and very harmful to man, as food, as agents for the fertilization of plants, as pests of food crops, and as vectors of human disease. See also ARACHNIDA; ARTHROPODA; CRUSTACEA; INSECTS.

**Mollusca and Other Phyla.**—The phylum Mollusca includes the clams, oysters, chitons, snails, whelks, slugs, squids, and octopuses. Usually there is a calcareous shell, and a prominent feature of the body is a muscular locomotor organ known as the foot. In the squid and octopus this has been modified into a series of tentacles with sucking discs. The latter forms are adapted for rapid swimming in a backward direction by the ejection of water from a mantle cavity. In the other mollusks locomotion is achieved by creeping or burrowing. Breathing is by means of gills and there are well-developed but unsegmented circulatory, excretory, reproductive, and



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Reconstructed fossil amphibian *Diplovertebron*, an animal of the Carboniferous period.

nervous systems. See also MOLLUSCA.

The phyla Entoprocta, Bryozoa, Phoronidea, and Brachiopoda consist of tentacled animals (the last-mentioned group with a pair of clam-like shells and well represented in fossil fauna) that are of interest as problems for the specialist. See also BRACHIOPODA.

**Chaetognatha, Echinodermata, and Chordata.**

The remaining three phyla of animals are related. The Chaetognatha consist of some marine arrowworms; the Echinodermata, of the starfishes, brittle stars, sea urchins, feather stars, sea lilies, and sea cucumbers; and the Chordata, of animals with a backbone or the stiff rod (notochord) that precedes it in development. The echinoderms are characterized by the possession of a skeleton of calcareous plates and a water vascular system that is used for respiration and sometimes adapted to locomotion. The condition of many organs, such as the nervous system, is complex. Echinoderms are unsegmented and show radial symmetry. Their ciliated larvae, however, are bilaterally symmetrical and like those of some primitive chordates. The mode of formation of the body cavities as pouches from the gut is remarkably similar in the two groups. For these and other reasons it is believed that the chordates arose in evolution by diversion of the development of the larvae of some animals ancestral to both echinoderms and chordates. See also ECHINODERMATA.

Like the echinoderms, the primitive chordates—sea squirts, sea pork, salps, acorn worms, and lancets—are marine organisms. They do not possess vertebrae as a backbone but have in its place a gelatinous rod that stiffens the body but

allows the bending movements used in swimming. This rod is found, at least in the embryo, in all chordates including man. When vertebrae form, they do so by growing around and displacing the notochord. All chordates also possess, at least in the embryo, gill arches and a dorsal hollow nerve tube. The most primitive living vertebrates, the cyclostomes such as the lampreys and hagfishes, have no lower jaws and no paired fins. The cartilaginous and bony fishes have both jaws and paired fins and, in addition, either small sharp toothlike or bony scales. All fishes breathe by means of gills, but some also gulp air and breathe with lungs. Amphibia usually breathe with lungs in adult life, but a great deal of respiration occurs through their moist skin. Although their four limbs enable them to crawl or hop about on land, amphibia, like the frogs, toads, newts, and salamanders, must, with very few exceptions, return to water to breed. Their eggs develop into tadpoles with gills, and after variable times these larval forms metamorphose into adults. The reptiles, having a moisture-retaining scaly skin, better lungs, and shelled eggs that will develop on land, are better adapted to land life. The birds are very similar in structure to reptiles, the obvious differences being associated with their adaptation to flight. Like the mammals they have a highly developed nervous system and a constant high body temperature. Some primitive mammals, like the duckbill platypus, demonstrate their relation to reptiles not only in many structural features, but especially in that they lay eggs. Nevertheless, they have hair, feed their young with milk, and have many mammalian structural characteristics such as three ear bones. In other mammals, mostly of the Australian region, the young are born in an early stage of development when only a fraction of an inch in length and are nursed in a marsupial pouch on the mother's belly. In the remaining mammals, to which group man belongs, the young, attached by means of a placenta and an umbilical cord, are retained until birth in the uterus of the mother. See also AMPHIBIA; BIRDS; FISH; MAMMALS; REPTILES; VERTEBRATA.

#### 4. Evolutionary Zoology

**Fossil Record.**—The mammals are now the foremost animals on earth, but this was not always so. Reptiles were predominant in the Mesozoic era, 70 million to 225 million years ago, when dinosaurs and other land, aquatic, and flying reptiles of a great variety of types existed. The only mammals found in the fossil record of that time are a few small insectivorous forms. Before the Mesozoic there were no mammals, no birds, and only a few primitive reptiles. The amphibia had already appeared, however, in Carboniferous times (over 300 million years ago) in the great bogs and swamps that gave rise to the oil and coal deposits of today. The earliest of these amphibia were very similar in structure to the air-breathing fishes that lived in the ponds of those times. This similarity even extended to their primitive limbs, which were not very different from the fins of their fish relatives. Before the Carboniferous there were no true land-living vertebrates, and the fishes of the time were either primitive or, if highly specialized, are not represented among present-day fish fauna. The earliest fishes existed between 300 and 400 million years ago, and study of

their fossil remains indicates that although in most cases they had a heavy armor of bone, they were much like the present-day cyclostome fishes. Before this, only invertebrate remains are found and, even earlier, only the skeletons of shelled protozoa.

This succession in the appearance of animal forms is a proof of the fact of evolution and confirms and amplifies the inferences about the course of evolution made from the study of living animals. Since all previously existing animals are not preserved in rock, and since all so preserved have not yet been found, the fossil record is bound to have gaps. In certain cases, however, the seriation is quite complete. The fossil history of the horse is well known, and it can be demonstrated how for about 50 million years there was a gradual increase in size with consequent improvement in speed and a gradual reduction in the number of toes until, at present, only one toe remains functional on each foot. The fossil history of man is also quite well known and involves improvement in upright gait and an increase in the size of the brain. When the use of implements was learned, man's influence on his environment increased explosively. In tracing such phylogenetic series the paleontologist must recognize the possibility that parallel evolution has occurred independently in several lines. This is known to have occurred in the evolution of the elephants and especially in the evolution of hoofed mammals.

**Comparative Embryology.**—The order of appearance of the vertebrates, from jawless fishes through the jawed fishes, amphibia, and reptiles to birds and mammals, is the order of increasing specialization of many features, such as the nervous system. This order is in a general way followed in the embryonic development of certain organ systems such as the heart and blood vessels, or the kidneys and the urinogenital ducts. For example, in human embryonic development at early stages the plan of the circulatory system is fishlike even to the extent that there are vessels that pass through gill arches. Only after modification through further development does the circulatory system differentiate into something characteristically mammalian. In fact, the differences between the various vertebrates are found to be less and less as earlier stages of embryology are compared.

Comparative embryology yields many clues concerning the course of evolution. For example, in the mammalian ear there are three bones, while in the ears of all other land-living vertebrates there is only one. The two extra bones in the mammalian ear develop from the same structures that form the jaw articulation in other vertebrates. Thus, in the evolution of mammals a new jaw joint is formed, and bones that were once parts of the jaw lie within the ear and function in hearing. These two mammalian ear bones are said to be homologous with the related jawbones in other vertebrates, the term "homology" referring to the evolutionary relationship existing among structures that are superficially different but fundamentally alike. The single bone in the ear of the lower land-living vertebrates is homologous with the third bone in the mammalian ear; these, in turn, are homologous with a bone that helps support the jaws of fishes. Again, the fins of fishes and the limbs of land-living vertebrates are homologous, but the wings of an insect and a bird are only analogous, having a similar function but



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Evolution of right hind foot of the horse, shown in progression of fossils to bones of the modern horse (right).

dissimilar structure and origin; they do not possess evolutionary relationship.

In the vertebrates changes during the course of embryonic development are brought about by the influence of one tissue on another. For instance, the nervous system is induced to form by the roof of the embryonic gut underlying it. Transplantation of this inducing gut tissue under the skin of a second embryo causes another nervous system to form. Similarly the lens of the eye is induced to form from skin by the embryonic eyeball. By influencing the course of these processes the hereditary constitution of various animals ensures development true to type. In some primitive chordates and in many invertebrates embryonic development does not involve such a stepwise determination of one tissue by another, but the potentialities of the cells formed by cleavage of the egg are fixed when the cleavage occurs. In this case separation of the cleaving egg into two parts results in two incompletely formed monsters rather than in two perfectly formed but miniature embryos as is the case with amphibia. There is an even broader recapitulation of phylogeny to be observed in the progression from a single-celled egg to the cluster of cells formed by cleavage. This cluster becomes a hollow sphere and, by the inward migration of some of the cells, a two-layered structure. A third, mesodermal layer then appears, and the body cavity forms within it.

**Physiology.**—Many evidences indicate that life arose in the sea. As the rivers bring salts from eroding soil and rocks into the oceans where water is constantly evaporating, the salt concentration of the sea increases. At the time when animals arose, the sea was more dilute than now. The earliest known vertebrates lived in fresh

water but had in their blood a concentration of salt similar to that of the sea at the time they left it, and to this day that concentration has been roughly retained. The closed blood systems of animals provide watery internal environments for their cells and thereby allow a type of freedom from the outside environment that has reached its culmination in the higher vertebrates. Among them the internal fluid is well buffered against chemical change and carries antibodies that protect the cells against invading viruses and bacteria; the keynote is constancy. Blood possesses an efficient means of transporting oxygen in the hemoglobin of the red blood cells, and it carries carbon dioxide from the cells of the body to the lungs. It also transports food from the gut, where it is dissolved by the action of enzymes formed in the digestive glands. The waste products secured from the tissue fluids around the cells are excreted as the blood passes through the capillaries of the kidney. The blood is moved by the muscular contraction of the heart and arteries and is given direction by the valves of the heart and veins. All of this activity is regulated by the action of the nervous system and the hormones secreted into the blood by the endocrine glands. These two systems control the metabolism of the body, the rate of heartbeat, and the contraction of skeletal and other muscles. These systems in turn respond to stimuli from within the body and from without as perceived by the sense organs. The entire physiology of the animal is adapted to preserve its pattern, but in time aging sets in and is eventually reflected in failure to function.

**Heredity and Variation.**—The pattern of animal organization is preserved from generation to generation by the reproduction of new individuals, usually by sexual means. When eggs and sperm are formed, the number of chromosomes is reduced to one half of the number normal for the body cells; upon fusion of sperm with egg the normal number is reconstituted. Chromosomes consist of a complex chemical, nucleoprotein, which is capable of existing in an immense number of specific forms. The chromosomes are the hereditary determinants of the cell. For example, the members of one pair of chromosomes in the human male are structurally different from one another and are known as X and Y. A human female has two X chromosomes. One of the X's is included in the egg when the chromosome number is halved; when the sperm is formed, either the X or the Y is incorporated. An X-bearing sperm, by combination with the X-containing egg, will result in a female offspring, while Y-bearing sperm can form only males.

The chromosome is linearly differentiated into sites known as genes. These are the units of heredity that determine all characteristics—sex, eye color, susceptibility to disease, and so on—by influencing the chemical reactions that result in these phenotypic characters. The gene determines the response that the organism can make to the environment in expressing the character. Thus, there is no conflict between heredity and environment; the two mutually interact. Some characters, such as eye color or blood-group type, are rather rigidly determined; others, like size and intelligence, may vary according to the environment within rather broad limits set by heredity. The Mendelian laws governing the transmission of hereditary material are now clearly understood. In accordance with them, sexual reproduction results

in recombinations of genes so that no two offspring (except derivatives of the same egg—identical twins) are exactly alike. This variability is made possible by the fact that genes, although extremely stable, mutate to new conditions at a rate of about once in a million reproductions. Such mutations occur under the influence of radiation and certain chemicals, and for other reasons.

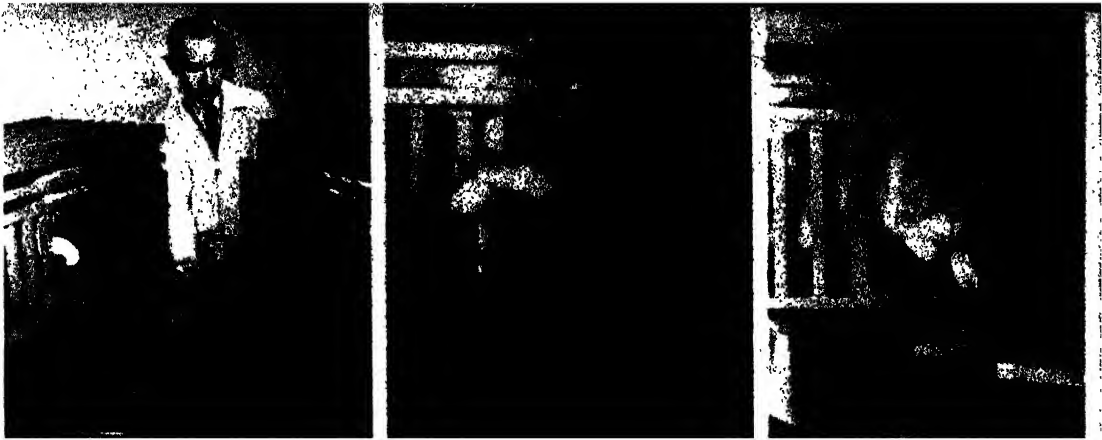
See also HEREDITY.

**Natural Selection.**—The differentiation among genes, giving rise to variability among offspring, provides the raw material out of which new species are built. With the possible exception of man, who controls his environment more extensively than other animals, no animal species overpopulates the earth, despite a reproductive capacity that is frequently enormous, as in the case of the codfish, which lays millions of eggs in a single spawning. Predators, lack of food, disease, and a multitude of other factors result in the survival of only a few offspring. The better fitted are those who have a greater chance of surviving and reproducing their kind; genes and combinations of genes having the greatest adaptive value are more likely to be spread in future generations. Thus evolution is brought about by the action of natural selection on hereditary variation. Man with his increasing control over the environment is in a position to influence his own evolution. It should be here borne in mind that, in addition to biological inheritance, social inheritance plays an important role.

There is a common explanation of evolution which is alternative to that involving spontaneous variation and natural selection. Usually attributed to Lamarck, it states that the temporary adaptations made by an organism in the course of its life are somehow transmitted to the germ cells and eventually to its offspring. Repeated experimental tests of this explanation have disproved it; the inheritance of acquired characters is simply not a fact. An adaptive environmental modification of an individual's body is important for the individual, but since it is not transmitted to its offspring, it is not the cause of evolutionary change. Furthermore, the Lamarckian explanation is not theoretically sufficient, for it fails to account for the appearance of the ability to undergo temporary adaptations such as the browning of human skin in the sun. The only explanation consistent with all we know about evolution is that involving the action of selection on the variation in heritable traits observed in all families.

As the area occupied by a species increases, regional differentiation into races sets in, due both to the nature of the reproductive process and to adaptation to different ecological opportunities. This differentiation may become so extensive as to introduce biological barriers to reproduction between two geographically or ecologically separated races. Among such reproductively isolated groups an exchange of genes is impossible and as a consequence the two groups would be considered to have differentiated into species. From then on they follow genetically independent evolutionary pathways toward further radiation or to extinction in the face of drastic changes in environment or competition with more successful groups.

Considerable progress has been made in the mid-20th century in the understanding of the process of animal evolution. Among the scientists who have contributed importantly to this progress are Sir Ronald Fisher, Sewall Wright, J. B. S. Hal-



All photos by Nina Leen—Pix

Animal intelligence test: Cats in separate cages must open trick doors to cross paws, use leverage to turn door latch. Door falls flat, cat

food placed between them. to take reward of its

dane, Theodosius Dobzhansky, and George Gaylord Simpson.

See also DARWINIAN THEORY; EVOLUTION, ORGANIC; NATURAL SELECTION; RACES, NATURE AND ORIGINS OF.

**Instinctive Behavior.**—Rapid and fascinating progress has also been made in the study of animal behavior, conducted largely by a group of contemporary Europeans, among whom Konrad Lorenz, Karl von Fritsch, Nicolas Tinbergen, and Gustav Kramer are especially prominent. This group of investigators, focusing attention on instinctive behavior, has discovered that certain forms, color patterns, sounds, and movements elicit automatic responses and that animals communicate with one another in this way. Bees, for example, are able to tell other members of their hive of the location of sources of food by performing a "dance" oriented with regard to the location of the sun at the moment. Such sun-directed orientation seems widespread among animals. Birds, for instance, can match the sun's position with the time of the day as they measure it by some internal rhythm or "clock." If there is a discordance with their recent experience, they will

"home" or fly in a direction that brings a familiar agreement of the position of the sun with the time of day. When the time comes for migration, they seek a new alignment in response to a new hormonal condition within their bodies. In this way the young of the Pacific golden plover, newly hatched in Alaska and held back after others have left on their migratory flight, will upon release fly over the open ocean directly to Hawaii without previous experience. All this is instinctive. Other animals, especially mammals such as man, depend much more on what they learn.

**Importance of Zoology.**—Why should man concern himself with a study of animals? In the first place zoology, like all knowledge, has practical applications. As engineering is to physics and chemistry, so veterinary medicine, animal breeding, fishery and wildlife studies, and the control of crop pests stand in relation to zoology. The kind of knowledge that zoologists are interested in discovering is basic knowledge, that is, knowledge that is generally applicable to many animal forms. As a consequence, human medicine is especially dependent on knowledge gained by zoologists. In recognition of this dependence

Left: Pair of cats must cooperate to pull string, draw food within reach. Center: Reluctantly collaborating, cats are impatient as prize nears. Right: Aggressive cat shoves other aside, claims prize of joint efforts.

All photos by Nina Leen—Pix





four Nobel prizes in physiology and medicine have been given to zoologists: to the German embryologist, Hans Spemann (1935); to the American geneticists, Thomas Hunt Morgan (1933) and Hermann Joseph Muller (1946); and to the English zoologist, Peter Brian Medawar (1960). Most important of all, men are interested in zoology because, as animals, they want to know themselves, their relations, and their past history.

FRANCIS J. RYAN.

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**ZOOMORPHISM**, zō-ō-mōr'fiz-əm (also **THERIO-MORPHISM**), in comparative mythology and folklore and in primitive religion, the assumption of animal form by humans, or representations of such metamorphosis in literature, in symbolism and the arts, and in religious ritual and dance. At its most primitive level, zoomorphism envisages a basic kinship between man and animals in a system of totemism (see **TOTEM**). In lower mythology, and particularly in lycanthropy, men were thought to become werewolves (see **WEREWOLF**) by mere contact with animals, while witches and even the devil himself were believed to enjoy an extension of their own powers by means of their familiar spirits, in whose animal forms, whether of dogs, cats, hares, or others, they were wont to deport themselves. Injury to the familiar brought corresponding hurt to the witch herself. In ancient Egypt many of the gods were conceived in animal form, or as part human, part animal, while in Greek and Roman antiquity the gods were envisioned as being able to transform themselves into animal shape at will. Zeus' assumption of various animal guises to pursue his amours, for instance, constitutes the most celebrated illustration of zoomorphism in literature. Animal shape-shifting has carried over into folktales, such as the Cupid and Psyche cycle and the Swan Maiden stories. See also **ANIMALS**, **SACRED**; **POLYTHEISM**.

WAYLAND D. HAND.

**ZORACH**, zō'rākx, William, American sculptor and painter: b. Eurburg, Lithuania, Feb. 28, 1887; d. Bath, Me., Nov. 15, 1966. In his youth he lived in Ohio with his parents and then worked in a Cleveland lithographic plant. After studying art in New York City and Paris, he taught at the Art Students League in New York. His early interest was in cubist painting, but about 1917 he turned to sculpture. At first he worked in wood and clay, but later he used stone almost exclusively, employing a method of direct carving that retained the characteristics of his basic material. Zorach is considered a romantic realist, and his work is representational, yet structurally abstract. He is represented in many museums in the United States, such as the Whitney Museum, the Museum of Modern Art, and the Metropolitan Museum of



Radio City Music Hall

*Dancing Girl*, by William Zorach, exhibited in Radio City Music Hall, New York City. The work is cast in aluminum.

Art in New York, and also in many private collections. He was the sculptor for the Post Office Building in Washington, D.C., and for a façade of the Mayo Clinic Building in Rochester, Minn. His *Dancing Girl*, cast in aluminum, is in Radio City Music Hall, New York. He wrote *Zorach Explains Sculpture* (1947).

Consult Wingert, P., *Sculpture of William Zorach* (New York 1938); Baur, J., *William Zorach* (New York 1959).

**ZORN**, sörn, Anders (Leonard), Swedish sculptor, painter, and etcher: b. Mora, Sweden, Feb. 18, 1860; d. there, Aug. 22, 1920. After studying sculpture and water-color painting at the Stockholm Academy, he settled in 1882 in London, where he learned etching methods, turned to oil painting, and was a popular success as a portraitist. When he went to Paris in 1887, he experimented with impressionist techniques. Later Zorn traveled widely in many countries, including the United States, where he painted portraits of such notables as Theodore Roosevelt and William Howard Taft. During his lifetime he ranked among the leading Swedish artists and was esteemed especially for his genre scenes of peasant life and paintings of female nudes. Among his sculptures is a statue of *Gustavus Vasa* at Mora. Though he considered his etchings only a pastime, they are now the most highly regarded of his works.

**ZOROASTER**, zō-rō-ās'tar, founder of the ancient Iranian religion known as Zoroastrianism, and author of the Gathas, 17 religious poems embedded in its scripture, the Avesta: b. 630/618 B.C.; d. 553/541 B.C. The Greeks came to hear of Zoroaster from the magi, the priests of Western Iran, around 400 B.C. The evidence suggests that at that time the magi had only recently been driven to making Zoroaster's teachings

their own, and for reasons of prestige were claiming that the prophet had been of their own stock, a Western Iranian magus. This fiction, in whose context the prophet's name was quoted in its Old Persian form "Zara-ushta," which the Greeks turned into "Zoroaster," gained currency among classical writers; and they continued to describe Zoroaster as a Persian or a Mede even after Hecataeus of Abdera, toward the end of the 4th century B.C., had correctly reported that the prophet, whom he calls "Zathraustes," had been active "among the Ariani." The authors of the Avesta display no acquaintance with Persis or Media, but they often mention a country Aryana Vaejah (Iranian Expanse) which, since they describe it as "the best which God created," was probably their own. Hecataeus' "Ariani" must be recognized as the inhabitants of Aryana Vaejah, and his "Zathraustes" as a Greek rendering of "Zarathushtra" (Camel Driver), the form which the prophet's name has in the language we call Avestan—the language, that is, of the prophet as well as of the "Ariani."

To judge from the linguistic position of Avestan among the other Iranian languages, and from the geographical horizon of the Avesta, Aryana Vaejah lay approximately where the present-day boundaries of Iran, Afghanistan, and Soviet Turkmenistan meet. The country must have lost its independence when Cyrus the Great (r. 559–529 B.C.) incorporated the eastern Iranian regions into the Persian Empire. The ruler of Aryana Vaejah whom Cyrus deposed was presumably King Vishtaspa of the Kavi dynasty—not to be confused with Vishtaspa (Hystaspes), father of Darius I—since no successor of his is mentioned in the sources. Vishtaspa himself, however, looms large in the Zoroastrian tradition as the prophet's protector and friend.

**Life.**—The Iranian sources on Zoroaster fall into four main groups, which will be referred to as: A, the 6th century B.C. Gathas; B, the remainder of the Avesta, approximately from the 5th to the 3d centuries B.C.; C, the Middle Persian Zoroastrian commentaries, based on information available in and after the 3d century A.D.; and D, Firdausi's Persian epic, the *Shah Nameh* (*Shahnama*), 10th century A.D. Most biographical data on the prophet are not to be found in sources earlier than C, but allusions in the Avesta sometimes bear them out. Thus the obscure reference in B to "the mountain and the tree of the two who discuss holy matters" is likely to allude to the seven revelations that Zoroaster is said in C to have received from his God between his 30th and 40th year of life. The name Maidyoimanha, laconically cited in the Avesta, belonged according to C to Zoroaster's cousin and first convert. Even the illustrious converts Jamaspa and Frashaoshtra, often mentioned in A and B, are identified only in C—the former as Vishtaspa's grand vizir and husband of Zoroaster's youngest daughter; the latter as Jamaspa's brother and father-in-law of the prophet.

Zoroaster's year of birth can be calculated from a date given in C as either 630, or 628, or 618 B.C. From the account of C it appears that the prophet reached the age of 77 and that the turning point of his career occurred at the age of 42, when he succeeded in converting Vishtaspa. The rebuffs which, according to C, he suffered earlier are reflected in a number of Gathic verses: hostile priests and teachers are mentioned; a prince refused him hospitality; he did

not know where to turn; and a salary he had been promised was not paid. But after Vishtaspa with his family and court had been won over, the position of the prophet and the success of the new faith were assured.

Zoroaster's see is stated in B to have been Raga. This district, although usually identified with an area near present-day Teheran, should rather be looked for, on the strength of its position in an Avestan list of countries, in eastern Afghanistan. Raga may have been the home district of the prophet, whose language, as attested in A, has distinct vernacular traits. Unfortunately the location of the river Drja, near which according to B stood the house of Zoroaster's father Pourushaspa, is unknown.

Several enemies of Vishtaspa's are mentioned in the Avesta. Against one of them, Ariataspa, king of the Hyaonas, Zoroaster's protector led, according to C and D, a prolonged religious war, of which these late sources give detailed accounts. Although in the end the Hyaona invaders were routed, this happened only after the prophet had fallen a martyr at their hands.

**Thought.**—Among the Iranian contributions to world thought Zoroaster's is not only the earliest but also the one which ranks highest. Despite the immense difficulties of interpretation, no one who has studied the prophet's utterances can escape the impression that he had anticipated, and possibly originated, some of the assumptions of Greek, Jewish, and early Christian thinking. Although the extent to which these three sources of Western civilization were indebted to him eludes us, his conception of God and of man's destiny still seems remarkably akin to the one which prevails in the West.

The chief features of Zoroaster's vision are his incisive solution of the problem of evil, of which he absolves God without detracting from His omnipotence; the pivotal significance of Truth in his system; the dignity he confers on man as a free and responsible agent; and the belief in a Savior and a resurrection into a state of eternal perfection. Such a vision, in the 6th century B.C., only a powerful mind could have conceived. Intellectual power also pervades his versification, which, although based on inherited patterns, stands out unmatched in originality and concentration among the early products of Indo-European poetry.

See also ZOROASTRIANISM.

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**ZOROASTRIANISM**, zō-rō-ās'trē-ən-iz-əm, the religious system of ancient Persia, founded by Zoroaster sometime between the 9th and 6th centuries B.C.<sup>1</sup> and still professed by some 20,000 Gabars in Iran and 120,000 descendants of emigrants (the Parsis) in Bombay, India, and surrounding towns. Its sacred book is the Avesta (Zend-Avesta); there are also treatises in a less ancient language, Pahlavi. See PARSIS; ZEND-AVESTA; ZOROASTER.

**History.**—Zoroaster's reform seems to have originated in northeast Iran, whence it spread

<sup>1</sup> Editor's Note: Some authorities date Zoroaster more definitely in the 7th–6th century B.C.

southward and westward during the Achaemenid period (6th–4th centuries B.C.), although it is not quite certain that Darius I and his successors, who worshiped Ahura Mazda, were followers of Zoroaster. After Alexander's conquest of Iran (331 B.C.), Greek and Semitic elements invaded the religion until toward the end of the Arsacid period (c. 250 B.C.–226 A.D.) the native civilization began to revive. Then with the advent of the Sassanid dynasty in 226, Zoroastrianism was established as the official religion of the Iranian Empire. It had to combat not only Christianity but also Manichaeism, a gnosis made up of Greek, Jewish, and Iranian elements, whose founder Mani was persecuted by Karter, the Zoroastrian high priest, and put to death under King Bahram I (r. 273–276).

At the beginning of the 6th century A.D. a new, communistic religion was preached by Mazdak and favored by King Kavadh I, whose son Khosrau I (r. 531–578), however, restored the traditional order, defined orthodoxy, completed the Avesta, and consolidated the Zoroastrian church. After him the Sassanid empire declined until it was destroyed by Mohammed's followers in 641. Islam tolerated the ancient religion in principle, but conversions, either by persuasion or by force, were massive in some provinces. However, there were spots of survival, notably in Fars, where the works in Pahlavi were produced. They purported to salvage as much of the religion as was possible in the face of approaching disaster.

From the 11th century onward the movement of national revival in Iran was usurped by chiefs of Turkish origin, the Ghaznavids, Ghurids, and Seljuks, who leaned on orthodox Islam against both Shi'ism and Zoroastrianism. Firdausi's *Shah Nameh*, the great epic sponsored by Mahmud the Ghaznavid (r. 999–1030), extols the glorious past of Iran, but Zoroastrianism plays very little part in it, and the entire poem is placed under the invocation of Allah. Zoroastrianism partly survived in the form of elements amalgamated into the Muslim religion of Iran, but as an autonomous religion it persisted only in a few remote places like Yazd (Yazd) and Kerman. One or more parties of Zoroastrians left Iran for the island of Hormuz (Ormuz) in the Persian Gulf, then for India, where they settled in Gujarat and later spread to Bombay. There they were called Parsis (Persians) after their country of origin, and their religion was called Parsism. Contact was lost with their Iranian brethren the Gabars (literally "infidels," a name given them by the Muslims), but it was restored in 1477 for three centuries in an exchange of letters and visits. As a consequence of this intercourse Parsism split into two sects over a question of calendar.

**Ritual.**—The chief ceremony of Zoroastrianism is the *yasna* or sacrifice, an offering of *haoma*, the sacred liquor (in India, *soma*), together with water and milk libations in the presence of a fire, in honor of Ahura Mazda (Ormazd, Ormuzd) and lesser deities and for the benefit of the dead or the living. In the course of this ceremony the main part of the Avesta is recited, including Zoroaster's Gathas. The *yasna* is essentially a life rite, destined to promote the forces of life against the demons who are supporters of death and evil. In former days the slaughtering of animal victims was part of the ritual. Although condemned by Zoroaster, at least in its cruellest forms, animal sacrifice survived well into medieval times but is now extinct.

Fire is an object of special reverence. It is kept burning in the temple and fed at fixed intervals, and embers from all the fires of the community are brought to it periodically for regeneration. The installation of a new fire temple is, especially in its final phase, one of the major festivals of the Parsis; the fire is enthroned as a king. In ancient times, fire was an instrument of ordeal, and it was taught accordingly that in the world to come, with the final renovation of all things, fire would help in distinguishing the good from the wicked. It was therefore associated with truth or justice. Moreover, fire was thought to be all pervading as a kind of life fluid, coming down from heaven in the lightning, which penetrates the waters and feeds the plants (from which fire can be extracted through friction), which in turn feed the animals and man and give them animal warmth. This ancient theory, which also appears in the Upanishads, was especially developed in Iran in the notion of Xvarnah, an emanation of the sun that descends upon each individual but particularly upon kings and saints and resides in their heads, from which it radiates in the form of the nimbus or rays. This concept seems to have been passed on to Buddhism, Christianity, and Islam.

The most conspicuous feature of Zoroastrianism, apart from the fire ritual, is the practice of disposing of the dead by exposing them to birds of prey (formerly also to dogs) in so-called Towers of Silence, to avoid defiling the earth, fire, or water. There are several ceremonies of purification, entailing washings with water, sand, and bull's urine, and the presence of a "four-eyed" dog (with two dark patches above the eyes), which is also used in the funeral rites. Every Zoroastrian has to be received into the fold of the "good religion" by donning a sacred shirt and a sacred thread or *kusti*, which will never leave him again even in death and to which symbolic values are attached.

**Ethics.**—Two principles form the basis of the Zoroastrian code of ethics: the maintenance of life, and the struggle against evil. In order to maintain life, one must raise cattle and till the earth, and marry and have children. Asceticism and celibacy are condemned. To fight evil is to combat the demons and all beings, either human or animal, belonging to them. If the two principles come into conflict, the second one prevails. Each man can and must choose freely between good and evil.

**Dualism.**—A central feature of Zoroastrianism is its doctrine of dualism, which personifies the opposing principles of good and evil and recognizes the universal sway of these hostile forces. The powers of good are led by Ahura Mazda (the Wise Lord); those of evil by Ahriman (Angra Mainyu; the Evil Spirit). Each has an array of warriors. On one side are bands of angels and archangels; on the other, companies of demons and archfiends. Under the general name of Amesha Spentas (Immortal Holy Ones) are grouped the six archangels who personify fundamental virtues and abstract ideas, and whose names represent Good Mind, Excellent Truth, Wished for Kingdom, Devotion, Wholesomeness, and Non-Death. In addition there are a number of angels and lesser divinities called Worshipful Ones. In the opposing army a crowd of lesser fiends and demons (including the daeva Aeshma) accompany the six archfiends. See also PERSIAN MYTHOLOGY.

**Millennia.**—According to Zoroastrianism, the world's history is a contest between good and evil, or light and darkness, which will endure for 12,000 years, divided into four equal periods. The first period is one of spiritual existence. Conscious that Ahriman lives, Ahura Mazda makes the world as a spiritual creation before it assumes material form. When Ahriman discovers his enemy at work, he arouses to life his army of demons and fiends. In the second epoch Ahura Mazda creates the material world, which is invaded by Ahriman and his cohorts. The third period marks the contest for mastery between the rivals and the battle for the human soul until Zoroaster is born. The fourth and last epoch then begins. The prophet and his three sons, to be born in ages to come, the last being the Saoshyant, or Savior, preside over the final eon. As the world enters the stage of regeneration, with the resurrection and final judgment, Ahriman will form his hosts for a final battle. They will be defeated, and good will reign forever.

There was an age-long discussion during the Sassanid period between the pure dualists and those who recognized, above the good God and the evil Demon, a unique principle, Zurvan, or Infinite Time. In fact, although the Avesta has little trace of it, Zurvan was the supreme god in Iran at the time of Mani (d. 276 A.D.), for the Manichaeans never called their god Ahura Mazda but, sometimes, Zurvan. Ahura Mazda was in Manichaeism the name of the primal man. See also MANICHAEAENS.

**Resemblances in Greek Philosophy, Judaism, and Christianity.**—There are striking parallels between Iranian doctrine and pre-Socratic speculation in Greece. The chief of these, perhaps, is that between the *logos*, or "true sentence," as a cosmic principle, and *asha-arta* (in Vedic India, *ṛta*), the "true prayer," as universal law; and the association of fire with both. Additional traces of Iranian influence may be sought in Anaximander, Empedocles, Plato, and others.

Although a definite borrowing is still impossible to prove, the resemblances between Zoroastrianism and Judaism are numerous and important and probably took shape during the Exile. First, the figure of Satan, originally a servant of God, appointed by Him as His prosecutor, came more and more to resemble Ahriman, the enemy of God. Secondly, the figure of the Messiah, originally a future king of Israel who would save his people from oppression, evolved, in Deutero-Isaiah for instance, into a universal Savior very similar to the Iranian Saoshyant. Thirdly, the entities that came to surround Yahweh, such as His Wisdom and His Spirit, are comparable to the archangels escorting Ahura Mazda; the Spirit, in particular, is comparable to Spenta Mainyu. The six powers of God in Philo Judaeus' speculations are also comparable to the Iranian archangels. Since the latter were known to the Greeks, it is by no means impossible that Philo had heard about them. In fact, he mentions as quite familiar the Persian doctrine of God's virtues. But the likeness is limited to general analogy.

A more exact parallel is provided by the doctrine of the Two Spirits. Before the discovery of the Dead Sea Scrolls in 1947, there were only scanty traces of this in known Jewish literature, but the Manual of Discipline in the Dead Sea Scrolls provides a whole small treatise on the subject. One is immediately reminded of the doctrine of the Two Spirits in Zoroaster's Gathas, the

ethical and eschatological dualism of which can be detected here; but the predestination of the Two Spirits in the Jewish document is contrary to Zoroastrian free choice. One must therefore look for another Iranian source, outside the Avesta, to explain the absence in the Jewish document of what was the essence of Zoroaster's message: the part of the Two Spirits in the drama of choice. Predestination in contrast to free choice, the identification of the Two Spirits with light and darkness, and the explicit creation of these spirits by God leads back to the Zurvanist myth of a god of time or fate, father of the light Ahura Mazda and the dark Ahriman. Since this is the form under which the Jews presumably must have known Iranian religion at the time, the conjecture of borrowing seems confirmed.

Other points of comparison between Iran and Israel include the doctrine of the millennia; the Last Judgment; the heavenly book in which human actions are inscribed; the Resurrection; the final transformation of the earth; paradise on earth or in heaven; the ecstatic ascent of Enoch or Arda Viraf (an Iranian sage) into the heavens; hell; the souls of the animals accusing man in the Slavonic Enoch, like the soul of the ox in the Gathas; and, finally, in Tobias (Tobit), the demon Asmodeus, alias daeva Aeshma.

Christianity seems to owe many features to Iran, over and above those it inherited through Judaism. Among others are probably the belief in guardian angels, resurrection, and in the heavenly journey of the soul.

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**ZORRILLA Y MORAL, thõr-rë'lyä ä mó-räl', José**, Spanish poet and dramatist: b. Valladolid, Spain, Feb. 21, 1817; d. Madrid, Jan. 23, 1893. He was educated in Madrid, studied law in Toledo and Valladolid, but then turned to literature. The publication of *Poesías* (1837) won him immediate recognition as the leading figure of romanticism in Spain. In 1845–1846 and 1848–1855 he lived in France and then went to Mexico where, under the protection of Emperor Maximilian, he was commissioned to found a national theater. The fall of Maximilian brought his mission to an end, however, and Zorrilla returned to Spain, where he spent the rest of his life, first in Valladolid, then in Barcelona, and finally in Madrid. Between 1871 and 1873 he suffered bitter poverty despite the success of his plays, but eventually he received a government pension of 30,000 reales, and on June 21, 1889, in Granada, he was crowned poet laureate of the nation. An account of his life, though not strictly reliable, is his own *Recuerdos del tiempo viejo* (2 vols., 1880–82).

Like other writers in great popular esteem, Zorrilla has enjoyed high and low appraisals in literary history. There is no doubt that his work in lyric, narrative, and dramatic forms represents the decisive arrival of romanticism in Spain. His lyric poems and many "legends," or ballads, represent new stages in the descriptive powers of the



language and genuine remakings of traditional epic and legendary elements in Spanish history despite their excessive metrical fluency, copious stanzaic sweep, and occasionally distracting moralizing. *Cantos del trovador* (1841) is the first of several collections of verse legends. His dramatic work suffered from his great capacity to improvise and from the haste and quickness of his composition; but *El zapatero y el rey* (1840) and *Traidor, inconfeso y mártir* (1849) are plays in which the thematic preoccupations of romanticism—national tradition and religious belief—are given effective presentation. His *Don Juan Tenorio* (1844) gives the theme of the eternal seducer as archetype such surface attraction that it is likely to remain a popular masterpiece.

EUGENIO VILLICAÑA.

**ZOSHCHENKO**, zô'shchën-kô, **Mikhail Mikhailovich**, Russian writer: b. Poltava, Russia, 1895; d. Leningrad, July 22, 1958. His humoristic sketches and tales made him widely popular in the USSR in the 1920's. His satirical stories dealt with the pettiness of Soviet citizens and the incongruities of the new way of life. The narrator of these realistic descriptions spoke a peculiar idiomatic language, called later "Zoshchenko's tongue." In the 1930's Communist critics accused him of anti-Soviet feelings. In 1943 the publication of his psychological, introspective novel *Pered voshchodom solntsa* (Before the Dawn) was stopped by governmental order, and in 1946 he was formally accused by party leaders and expelled from the Union of Soviet Writers. He hardly published anything after the "purge" and died in solitude and oblivion. Selections from his works appeared, however, after Stalin's death.

Zoshchenko is certainly the leading humorist of Russian post-Revolutionary literature, and his puns and anecdotes have amused millions of readers. The figures of half-baked Communists and lower middle-class knaves and bureaucrats portrayed in his snapshots of Soviet reality have become symbolic of certain Russian social groups of the period. A selection of his stories in English translation is *Scenes from the Bathhouse and Other Stories of Communist Russia* (1961).

MARC SLONIM.

**ZOSIMUS**, zô'si-mäs, **SAINT**, pope: d. Rome, Italy, Dec. 26, 418; r. 417–418. Little is known of his antecedents. The *Liber pontificalis* calls him Greek, but his father's name, Abraham, has caused some to consider him originally Jewish. On the morrow of his election as pope (consecrated March 18, 417) Zosimus conceded extraordinary powers of superintendency over the Gallic church to Patroclus, bishop of Arles, who was in high favor at the court of Ravenna and who, it has been thought, may have exercised preponderant influence in the succession of Zosimus to the papal chair after the death of Innocent I. This action was resisted by the Gallic bishops. Further complications soon arose in the Pelagian controversy (see PELAGIANISM), and Zosimus became embroiled in an interchange on this subject with the bishops of Africa. Even at Rome itself, dissatisfaction was felt with the stormy administration of this pope, and the urban clergy took their grievances to the emperor at Ravenna. Zosimus had a strong sense of the rights of the Apostolic See, which he ceaselessly strove to enforce; but lacking tact and finesse, his efforts had the contrary effect and opened the way for the state to intrude into

the affairs of the Roman Church, thus nullifying the prudent work of his predecessors. One of his decretals, addressed to Hesychius of Salona, was given place in old canon law. It forbade monks or laymen to be promoted to episcopal rank without having passed through subordinate offices for a determined time.

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**ZOSIMUS**, Byzantine historian: fl. 5th century. A count and a lawyer connected with the imperial treasury, he appears to have been also an ancient Edward Gibbon, for he wrote his *Historia nova* (New History) to demonstrate the decline of the Roman Empire. The work, in six books, starts with Emperor Augustus' reign (27 B.C.–14 A.D.) and ends with Alaric I's sack of Rome (410). His professed devotion to the pagan divinities and consequent animus against Christianity led him to ascribe the empire's gradual decay to Christianity's antagonism toward paganism. Apart from this, Zosimus is generally trustworthy, displays good historical judgment, and writes clearly and concisely. Although his work sometimes shows scant interest in chronology, it is among our chief authorities for the history of the 4th century.

P. R. COLEMAN-NORTON.

**ZOSTERA**. See EELGRASS.

**ZOUAVES**, zō-ävz', originally a French infantry corps recruited in Algeria from the Zwawa tribe of Kabyles after the French conquest in 1830. They had previously served the Algerian deys as mercenaries. By about 1840 the Algerians were eliminated from the corps and replaced by French soldiers, who retained the native dress. Papal Zouaves were recruited from French soldiers at Rome in 1860 under Gen. L. C. Léon Juchault de Lamoricière, a former commander in Algeria, to defend the temporal sovereignty of the pope. They were unsuccessful against the Italian troops at Rome in 1870, and after serving in France during the Franco-Prussian War, they were disbanded in 1871. Several regiments of volunteers in the American Civil War were called Zouaves because they adopted the dress and drill of the French Zouaves (see ELLSWORTH, ELMER EPHRAIM).

**ZOUCHE**, zōsh, **Richard**, English authority on civil law: b. Ansty, Wiltshire, England, 1590; d. London, March 1, 1661. Educated at New College, Oxford, he was admitted as an advocate of Doctors' Commons in 1617, and in 1620 became regius professor of civil law at Oxford. In addition to his university duties he had a large practice in London. In 1641 he was made judge of the High Court of Admiralty. Zouche was a Royalist, though not a pronounced one, during the



Civil War; and although he was replaced in the judgeship in 1649, he was appointed by Oliver Cromwell to a special commission of oyer and terminer, and retained his academic appointments. After the Restoration he was a member of the commission that reinstated the professors and fellows of Oxford who had been removed under the Protectorate.

Zouche's writings include a descriptive poem, *The Dove, or Passages of Cosmography* (1613); a comedy, *The Sophister* (1639); and many professional legal works, most important of which are *Elementa jurisprudentiae* (1629), a general system of legal science, and *Juris et iudicii fecialis . . . explicatio* (1650), regarded by critics as the first treatise containing a systematized arrangement of international law.

**ZRENJANIN**, zrě'n'jä-nĭn, city, Yugoslavia, in Vojvodina, northern Serbia, 26 miles east-northeast of Novi Sad. It is a rail center on the Belgrade-Kikinda Railroad, and a port on the canalized Begej (Bega) River. Manufactures include dried beet pulp, sugar, agricultural machinery, molasses, and dairy products. Other industries are flour milling, brewing, carpet making, and vegetable canning. The city was called Veliki Beckerek until the 1930's, and Petrovgrad thereafter until about 1947. Pop. (1971) 60,201.

**ZRINYI**, zrĭ'nyĭ, **Miklós** (Croatian **NIKOLA ZRINJSKI**), Croatian-Hungarian soldier: b. 1508; d. Sziget (now Szigetvár), Hungary, Sept. 7, 1566. Member of an old and eminent Croatian noble family, he distinguished himself at the siege of Vienna in 1529 and in campaigns against John Zápolya and the Turkish sultan Suleiman the Magnificent.

During the contest for the Hungarian throne between Zápolya's son and successor John Sigismund and the Habsburgs, John Sigismund appealed to Suleiman for assistance. Zrinyi as ban (viceroy) of Croatia, an autonomous territory loyal to the Habsburgs, defended his banat against a Turkish army led by Suleiman himself. When Suleiman besieged Sziget in 1566, Zrinyi had only 3,000 defenders against the enemy hosts, but they resisted from August 5 to September 7. In a final desperate battle Zrinyi and the few survivors of his garrison were killed. But Suleiman also died during the siege, and his army, having suffered heavy casualties, advanced no farther into Europe. Zrinyi's glorious feat of arms is the subject of an epic, *Szigeti veszedelem* (1651), written by his great-grandson of the same name.

**ZSCHOKKE**, chō'kə, (**Johann**) **Heinrich** (**Daniel**), German-born Swiss author and publicist: b. Magdeburg, Germany, March 22, 1771; d. Aarau, Switzerland, June 27, 1848. After seven years as a tutor, itinerant playwright and actor, and student of theology, humanities, and law at the University of Frankfurt am der Oder, Zschokke settled in Switzerland in 1796. He wrote a history of the Grisons (1798), served as head of the department of public instruction in Aarau, and was government commissioner of several cantons. In 1800 he established order in the Italian sections of Switzerland and in 1804 became a member, later head, of the federal board of mines and forests.

Zschokke achieved fame as a reformer and agitator as well as a publicist, editor, and historian. *Des Schweizerlandes Geschichte* (1822) was a

popular work of history. For the rejuvenation of the moral and political life of Switzerland, turbulent in the 1820's and 1830's, much credit is also due him. But Zschokke's greatest significance today lies in his imaginative and devotional writings. As a prolific author of tales he became known throughout Europe, England, and America (*Der Creole*, *Alamontade*, *Abenteuer der Neujahrsnacht*, and *Der zerbrochene Krug* are representative). The romance *Abällino, der grosse Bandit* (1793; Eng. tr., *The Brave of Venice*, 1805, by Matthew G. Lewis, who also turned it into the melodrama *Rugantino*, 1805) was dramatized and held the stage for generations. The later rationalist-pietist verse collections, *Stunden der Andacht* (8 vols., 1809-16; Eng. tr., *Hours of Meditation*), went through scores of editions. The works of few foreign authors have been translated into English as much as those of Heinrich Zschokke.

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**ZSIGMONDY**, zhig'mōn-dē, **Richard**, German chemist: b. Vienna, Austria, April 1, 1865; d. Göttingen, Germany, Sept. 23, 1929. He studied chemistry and physics at the universities of Vienna and Munich. August Kundt, at Berlin, called his attention to the colors produced when organic solutions of gold are painted on porcelain. Work on this problem led to Zsigmondy's fundamental research on colloids, for which he was awarded the Nobel Prize in chemistry in 1925.

Zsigmondy began his research with an investigation of ruby glass and ceramic colors produced by the dispersion of colloidal gold. The fact that the colors seemed to be independent of the chemical compounds in which the gold existed led him to suspect that the physical state of the gold was the basic factor. In order to investigate this state directly, he and Henry F. W. Siedentopf of Jena invented (1903) the slit ultramicroscope, with which gold particles of a diameter of one ten-millionth of a millimeter could be seen. Zsigmondy was soon able to show that the stability of gold colloids depends on a negative electrical charge associated with each particle; if this charge is removed, the system coagulates. As the particles grow larger, the color changes, and the relationship between color and particle size becomes clear. Coagulation can be halted at any time by the addition of protective colloids. The laws of colloid action were made evident by this research, and colloid chemistry became an exact science. From 1907 to 1929 Zsigmondy served as director of the Institute for Inorganic Chemistry at the University of Göttingen. He published an account of his life work in a volume entitled *Zur Erkenntnis der Kolloide*.

L. PEARCE WILLIAMS.

**ZUARA**, zwā'rə, town, Libya, in western Tripolitania, a port on the Mediterranean Sea, 65 miles west of Tripoli. It is a rail terminus and an oasis. The people specialize in camel breeding, sponge fishing, olive-oil pressing, and flour milling. Cereals, vegetables, olives, dates, and esparto grass are raised. Pop. 14,578.

**ZUBAYR**, Rahama. See ZOBEIR, RAHAMA PASHA.

**ZUCCARELLI**, tsōōk-kā-rē'lĭē, **Francesco**, Italian painter: b. Pitigliano, Tuscany, Italy, Aug. 15,

1702; d. Florence, Dec. 30, 1788. Although his fanciful landscapes no more than echo the work of Marco Ricci, he had studied assiduously with Pietro Nelli in Rome. He found an unvarying style that makes his pictures hard to date and his fame difficult to understand. He went to Venice about 1730, and by 1751 he was, according to his contemporary Richard Wilson, "a famous painter of this place." Joseph Smith, British consul there, patronized him and doubtless suggested his first English stay: 1752 to 1762; his second stay lasted from 1765 to 1771, during which he became one of the founder members of the Royal Academy (1768). In 1772 he was elected president of the Venetian Academy.

WALLACE BROCKWAY.

**ZUCCARO**, tsōōk'kă-rō, the name of two Italian painters:

**TADDEO ZUCCARO**: b. Sant'Angelo in Vado, Duchy of Urbino, Italy, Sept. 1, 1529; d. Rome, Sept. 1 or 2, 1566. Before his early death he had established himself, with amazing good fortune (in view of his meager talent), as an influential mannerist painter. He undertook important decorative frescoes for the Farnese both in their Roman palace and in their villa at Caprarola and also undertook to do frescoes in the Sala Regia of the Vatican. He was buried in the Pantheon, close to Raphael.

**FEDERICO ZUCCARO**: b. Sant'Angelo in Vado, Italy, 1542 or 1543; d. Ancona, July 20, 1609. The younger brother of Taddeo, he was the more considerable artist, and possibly the most renowned painter working in Rome during the second half of the 16th century. He studied with Taddeo and was early associated in some of his enterprises; he also worked much in Venice at this time. In 1566 he went to Rome to decorate the Sala Regia, but quarreling with members of the papal court, he fled first to France, then to the Low Countries, and finally to England. It was once believed that he remained there four years, but six months (1574-1575) comes closer to the truth. His portraits of both Queen Elizabeth and the earl of Leicester are lost; the drawings for them are in the British Museum. That he painted many portraits in England is a legend that is not yet dead, and as Sir John Summerson writes in *Painting in Britain: 1530-1790* (1953): "His name, taken in vain, is to be found on labels in most of the great houses of England." It took him five years to finish Giorgio Vasari's frescoes in the dome of the cathedral in Florence, after which he moved around a good deal. His career in Spain was clouded, and his frescoes in the Escorial were soon superseded. In 1595, under a papal charter, he reinstituted the Accademia di San Luca in Rome, the prototype of the Royal Academy, founded almost two centuries later in London by Sir Joshua Reynolds.

WALLACE BROCKWAY.

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**ZUCCHETTO**, tsōōk-kēt'tō, the skullcap of a Roman Catholic ecclesiastic. That of a pope is white, of a cardinal red, of a bishop purple, and of other ranks, black.

**ZUCCHI**, tsōōk'kă, **Antonio (Pietro)**, Italian painter: b. Venice, Italy, May 1, 1726; d. Rome,

Dec. 26, 1795. He completed his studies with Jacopo Amigoni, after which he toured the peninsula, studying and often drawing the ancient monuments. His professional alliance with the brothers Adam brought him to England, where he was an associate of the Royal Academy from 1770 to 1784. Although he did not marry the painter Angelica Kauffmann until 1781, he often helped her in carrying out her commissions. He also worked independently. Ceilings were his specialty. Good examples of his skill may be seen at Osterley Park, Kenwood House (London), Syon House, and various London houses. His work cannot always be distinguished from his wife's. After their marriage, Zucchi and his wife lived in Rome. In 1790 a paralytic stroke ended his active career.

WALLACE BROCKWAY.

**ZUCCHINI**, zōō-kē'nē, a variety of summer squash of the Italian marrow type, belonging to the Cucurbitaceae family, of the genera *Cucurbita pepo*. The bush-type plant has short stems with deeply lobed leaves. The fruits are relatively short, cylindrical, and blocky, of a creamy gray-green color, with darker green markings. The flesh is light greenish white when the fruits are small. In season comparatively early, the fruits are used for immediate consumption when young and immature, and boiled or steamed unpeeled. Zucchini is rich in vitamin A, with considerable amounts of riboflavin, iron, and calcium. The standard variety used by growers is the black zucchini, with fruits colored a deep dark green or nearly black. Troublesome pests are the squash bug, squash vine borer, and cucumber beetle. Some of the common diseases are bacterial wilt and mosaic. See also SQUASH.

HARM DREWES.

**ZUCKMAYER**, tsōōk'mī-är, **Carl**, German playwright, novelist, and poet: b. Mackenheim, Germany, Dec. 27, 1896; d. Visp, Switzerland, Jan. 18, 1977. He began writing poetry while in the German army in World War I. Although he also wrote novels, he is best known as a dramatist, and many of his plays have been filmed. His expressionistic play *Kreuzweg* was produced in 1920, followed by the exuberant utopian comedy *Der fröhliche Weinberg* (1925) and others, notably the antimilitarist satire *Der Hauptmann von Köpenick* (1931; Eng. tr., *The Captain of Köpenick*, 1932). His work was banned by the Nazi regime in 1933, and after living in Austria and Switzerland, he emigrated to the United States and remained in Vermont until 1946, when he returned to Germany. His later plays are considered his best, including the anti-Nazi drama *Des Teufels General* (1946); *Der Gesang im Feuerofen* (1950), about the French resistance movement; and *Das kalte Licht* (1955), about an atomic spy. *A Part of Myself* (1970) is his autobiography. His screenplays include *The Blue Angel* and *Rembrandt*.

**ZUG**, tsōōkh, canton, Switzerland, bounded by the cantons of Zürich on the north, Schwyz on the east and south, and Lucerne and Aargau on the west. With an area of 93 square miles, it is the smallest undivided canton in the country. The Lake of Zug, its most prominent natural feature, was an important link on a medieval trade route. The town of Zug, at the lake's northeast corner, is the capital and the only

town of size. The surface of the canton is mountainous in the south and southeast, where the Rossberg (5,196 feet) stands along the Schwyz border, and slopes gradually north and west until it becomes comparatively flat. A small lake, the Agerisee, lies in the southeast, and just east of its southern tip is Morgarten, scene of a memorable victory of the Swiss over the Austrians on Nov. 15, 1315. Much of the land is in farms, principally for stockbreeding, dairy products, and fruit. Industry is largely concentrated in the town of Zug, with textiles in Baar and papermaking in Cham. The inhabitants are German speaking and Roman Catholic, and Zug was one of the Catholic cantons that joined the Sonderbund (q.v.) in 1843. It belonged to the Habsburgs from 1273 until 1352, when it joined the Swiss Confederation, but the Habsburgs did not formally renounce their claims until 1389. Pop. (1960) 52,489.

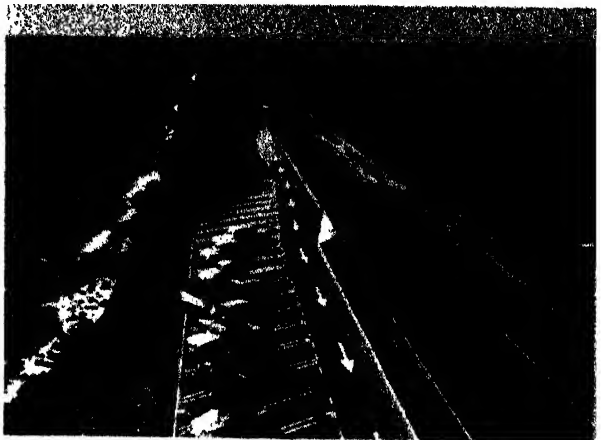
**ZUG**, town, Switzerland, capital of Zug Canton, at the northeast corner of the Lake of Zug, 14 miles south of Zürich. The older portion of the town contains many fine houses dating from the 16th century. There are four fortified watch-towers and traces of old defensive walls. The Late Gothic Church of St. Oswald, begun late in the 15th century, has some fine choir stalls. In the 16th century town hall is a historical museum. The Capuchin monastery, of the same period, has a notable altar painting by Denis Calvaert. Industry includes the manufacture of chemicals, tobacco and cigars, metalware, and a weaving mill. There is a station for the culture of fish, and the town is a military depot. In 1435, 1593, and 1887 parts of the town slid into the lake. Pop. (1960) 19,792.

**ZUG, Lake of**, lake, Switzerland, touching the cantons of Zug, Schwyz, and Lucerne, southwest of the Lake of Zürich and north of the Lake of Lucerne, at an altitude of 1,357 feet. The lake is about 9 miles long from north to south and 2½ miles wide, with an area of 15 square miles and a maximum depth of 649 feet. The Rigi (5,908 feet) rises boldly to the south, with the Rossberg to the east of it, and farther north on the east shore stands the high plateau of the Zugerberg. Elsewhere the lake is surrounded by gently sloping hills. The Lorze River flows through the north end of the lake, entering from the east and leaving to the northwest, and the Kiemen promontory protrudes from the lake's western shore. The principal town on the lake is Zug, at the northeastern corner.

**ZUIDER ZEE**, zī'dər zā', Du. zoi' dər zā', a former shallow inlet of the North Sea in the northern and central Netherlands. It was once a lake, known in ancient times as Flevo Lacus. In the 13th century a major flood breached the land between the lake and the North Sea, leaving a series of islands across the mouth of the inlet. The major resulting islands were Texel, Vlieland, Terschelling, Ameland, and Schiermonnikoog, collectively known as the West Frisian Islands. The inlet was 80 miles long, and several channels, the principal being Marsdiep and Boornkensdiep, still provide communication with the North Sea.

Reclamation of the Zuider Zee has been a major project in the Netherlands since the 17th century, but substantial work did not begin

until 1920. The project proposed reclamation of 500,000 acres in five separate <sup>termed</sup> polders, and the creation of a freshwater lake to be known as the IJsselmeer. In 1932 the Zuider Zee was split into two main portions, the IJsselmeer and the Waddenzee, with the completion of a dike, the Afsluitdijk, which connects the provinces of North Holland and Friesland and seals off the Waddenzee and



Engelhard from Monkmeyer  
Highway on the Afsluitdijk, 20-mile-long dike separating the IJsselmeer from the Waddenzee, a branch of the North Sea. Dike is part of the Zuider Zee reclamation scheme.

the North Sea. Locks permit the passage of barges from the Rhine River. Before World War II the northwest (Wieringermeer) and northeast polders were completed and prepared for cultivation. At the time of the German invasion of the Netherlands in 1940, work was proceeding on the remaining polders. Later in the war the Germans breached the dikes in order to delay the Allied advance, and much of the reclaimed land was flooded, but it was drained once more by the end of the war. In 1954 a 16-mile dike, linking the mainland town of Harderwijk with the new town of Lelystad on reclaimed land, was completed, and by 1956 the southeast polder (East Flevoland) was enclosed by a 66-mile dike extending from Harderwijk. When the entire project is completed, a 12th province of the Netherlands, Zuiderzeeland, will be formed.

**ZULIA**, sōō'lyä, state, Venezuela, in the northwest part of the country, 24,360 square miles in area. Shaped like a horseshoe, it lies around the entire shore of Lake Maracaibo, except where a strip of the State of Trujillo cuts in at the southeast. On the north it fronts the Gulf of Venezuela, and a narrow tongue of territory extends along the Guajira Peninsula. Colombia is to the west, with the Sierra de Perijá along the border. Of the rivers draining into Lake Maracaibo, the Catatumbo is most important. The northern plains are dry and hot, but in the lowlands of the south the climate is humid. The Venezuelan oil industry centers in Zulia, which is one of the world's major petroleum regions. On the lake's eastern shore, where derricks rise from the water, the fields of Lagunillas, Bacha-

quero, and Tía Juana are among the foremost producers. Oil is transhipped at Maracaibo, the capital of the state and Venezuela's second largest city. Leading agricultural products are sugarcane and rice, and livestock raising, particularly goat grazing, is extensive. Fine woods for building are found in the forests. The National University of Zulia is at Maracaibo, which also has an international airport owned by the government. Other airports in the state are owned by oil firms. Pop. (1950) 560,336.

**ZULOAGA**, sōō-lō-ä'gä, Félix, Mexican soldier and statesman: b. 1814; d. 1876. Having entered the National Guard as a lieutenant, he fought against the Yucatán secessionists in 1842-1843. Zuloaga at first supported Ignacio Comonfort (q.v.) when he became provisional president at the end of 1855, but he later turned against Comonfort's liberal policies and seized the presidency from him in January 1858. In the War of Reform that followed, Zuloaga was opposed by the Liberals, led by Benito Juárez. He was replaced in the presidency by the Conservative Miguel Miramón in February 1859. When the French invaded Mexico in 1861-1862, he left the country but returned in 1864 and tried unsuccessfully to overthrow Emperor Maximilian in 1865.

**ZULOAGA (Y ZÁBALETA)**, thōō-lō-ä'gä ē thā-bä-lä'tä, Ignacio, Spanish painter: b. Eibar, Spain, July 26, 1870; d. Madrid, Oct. 30, 1945. He first studied architecture in Rome but soon shifted to Paris, where he turned to painting, being much influenced by Gauguin and Toulouse-Lautrec. Returning to Spain, he evolved a sad, somber, and often brutal style, which may be called his own only with the qualification that it is founded on El Greco, Francisco de Zurbarán, Velázquez, and Goya. Composite though he was, he was hailed as the founder of a new school of Spanish art. He visited the United States in 1924, when he turned temporarily to fashionable portraiture. He barely survived his great renown; he lived on as a respectable artist who began to make his reputation a decade before Picasso turned from charm to revolution. A most copious painter, Zuloaga is represented in many art galleries, notably in Barcelona, Brussels, Paris (Luxembourg), and New York City (Hispanic Society). Whatever their artistic worth, his paintings are redolent of Spain, and he lived his life as a Spaniard to the full, being a celebrated amateur bullfighter.

WALLACE BROCKWAY.

**ZULU**, zōō'lōō, the name applied to over 2½ million Bantu-speaking people who dwell in specially reserved tribal areas in the Natal and Transvaal provinces of the Republic of South Africa, as well as on farms owned by Europeans. Many of them move periodically to work in the mines and towns and then return to their rural homes. A large number of people of Zulu origin also are permanently settled in the towns. Originally Zulu was the name of a small tribe living near the Tugela River, one of a congeries of tribes known as the Nguni, which from at least the 15th century onward—and almost certainly for many centuries before that—inhabited the southeastern region of Africa. Each tribe numbered 2,000 to 10,000 members and was independent under its own chief. The people

spread across the land in order to cultivate their grains, herd their cattle, and hunt. As a tribe grew in size, some of its component sections would secede periodically into independence under a near or distant kinsman of the chief, a man who had previously been an officer of the chief in a graded, authoritative hierarchy. Some secessions were peaceful; others followed on rebellions in which a kinsman of the chief tried to seize the chieftainship and the defeated party moved into independence. Neighboring tribes were usually at peace with one another, though raids for cattle and ransom occurred.

Apparently no chief tried to enlarge his dominion by conquering his neighbors until around the period after 1775, when pressure on land and possibly other factors began to produce wars of conquest. Early in the 19th century Chaka (Shaka), chief of the Zulu, embarked on a bloody war of conquest of the whole region. He succeeded by abandoning the throwing javelin for a more powerful stabbing spear and by the development of new military tactics. He enrolled all his men in regiments grouped by age and housed them for a large part of the year in barracks, ruled by a female relative. Here they drilled to move in disciplined order. His aim was to encircle his enemy by advancing with veterans at the center of his army and young regiments as wide-thrown wings that closed behind the enemy. The soldiers were forbidden to marry until their middle thirties, so Chaka had a permanent fighting force, trained to maneuver and to fight at close quarters. In his early years, when he was relatively weak, he used scorched-earth and guerrilla tactics effectively; later he developed something like the Roman *testudo* (q.v.) to assail mountain fastnesses. His armies raided into distant regions, and his wars were so devastating that he killed and put to flight over 1 million people. Some fleeing tribes established their own kingdoms in several widespread and distant parts of Africa.

Chaka enlarged the power of the chieftainship and ruled despotically until he was assassinated in 1828 by two of his brothers, one of whom, Dingaan (q.v.; Dingane) became king. Dingaan was defeated first by the Boers in 1838 and then by another brother in 1840. The kingdom, with its barrack system filled with unused warriors, survived until its conquest by the British in 1879. From 1887 to 1889, the Zulu chief and his subordinate authorities became junior officials in the administrative system of their white conquerors.

See also ZULULAND.

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**ZULULAND**, zōō'lōō-länd, district, South Africa, in northeastern Natal Province, 10,362 square miles in area, inhabited mainly by the Zulu. It is bounded on the north and northwest by Mozambique and Swaziland, and on the south by the Tugela River. Zululand consists of a

A kraal (village) of mud huts in Zululand, showing typical horseshoe formation, with circular cattle enclosure in foreground.

Information Service of  
South Africa

wide, often fertile coastal plain with a maximum width of 50 miles, and to the west a dissected semihighland area averaging about 2,000 feet in elevation. The latter is the traditional home of the Zulu, and Eshowe, the district capital, is found here.

Zululand's subtropical and well-watered climate is ideal for agriculture, but development has been handicapped by the land-reserve system. Approximately 86 percent of the native population resides in Zululand's 21 reserves (6,074 square miles); in many cases the reserves are so densely populated that only subsistence agriculture dominated by maize and livestock is possible. Most of the two major commercial crops, sugarcane and cotton, are grown on European lands, but expansion of these lands and crops, in turn, is limited by the native reserves. Other activities include the exploitation of wattle and eucalyptus. A paper mill at Mandini and scattered sugar mills make up Zululand's manufacturing. The beauty of the country and interest in the people's way of life contribute to tourism. Two rail lines and several motor roads radiate from Eshowe. The district boasts five game and several forest preserves.

The Zulu were a rather insignificant tribe until the early 19th century when Chaka (Shaka) became chief and, through despotism and conquest, built them into a powerful tribal unit. Chaka was murdered and succeeded by his brother Dingaan (q.v.; Dingane) in 1828. Ten years later Dingaan murdered 70 European voortrekkers who were negotiating with him for land. The voortrekkers under Andries Pretorius soon regrouped and in December 1838 broke Dingaan's power at the Battle of Blood River, killing 3,000 Zulu. The Zulu retreated into Zululand, built an impressive military force, and for 40 years remained relatively independent of European influence. Fear of Zulu attack on Natal prompted the British to issue an ultimatum to their chief, Cetewayo (q.v.; Cetywayo), to break up his military organization, but it went unheeded. In January 1879 British forces under the 2d Baron Chelmsford invaded Zululand and were soundly defeated at Isandhlwana, but Chelmsford returned in July and destroyed Zulu military power at Ulundi. To keep the area out of the hands of the Boers and Ger-

mans, the British placed it under a protectorate in 1887, and it was officially annexed to Natal in 1897. Pop. (1962) 470,000, including 456,000 Zulu.

See also NATAL; ZULU.

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**ZUMÁRRAGA**, thōō-mār'rā-gā, **Juan de**, Spanish prelate and first bishop of Mexico; b. Durango, Vizcaya Province, Spain, 1468; d. Mexico, June 3, 1548. He entered the Franciscan Order and was guardian of the convent of Abrojo in Spain. With the title of bishop-elect and protector of the Indians, he arrived in Mexico in 1528. He fought abuses by the secular authorities against the Indians and developed the Mexican missions, but misguidedly directed considerable zeal toward gathering and burning Aztec manuscripts. He was formally consecrated bishop of Mexico in 1533. His see was elevated to an archbishopric in July 1548, before news of his death had reached Rome.

**ZUMBO**, zōōm'bō, village, Mozambique, in the northwest, on the north bank of the Zambezi River at the Northern Rhodesian frontier, 220 miles west of Tete and 450 miles from the mouth of the Zambezi. Established as a trading post in the last part of the 17th century, it declined after a period of prosperity but has become partly revitalized in more recent years with the development of Mozambique and adjacent territories. The village mines coal and ships rice, manioc, and beans.

JOHN RALPH WILLIS, JR.

**ZUNI**, zōō'nē (officially **ZUNI PUEBLO**), village, New Mexico, in McKinley County, on the Zuni Indian Reservation, about 30 miles south of Gallup. It is a residential community of Pueblo Indian people, most of whom gain a living by agriculture and jewelry making. Located on the site of one of the ancient Seven Cities of Cibola, the present village was founded about 1700. The municipal government is by tribal council, with a governor elected for a two-year term. Population: 7,405.

See also ZUNI INDIANS.

FREDERICK J. DOCKSTADER.



**ZUNI INDIANS**, *zōō'nyē*, a tribe of North American Indians of the Zuniian linguistic stock living on a reservation in Valencia and McKinley counties, New Mexico. The name is a Spanish corruption of the Keresan *Súnyitsi*. The Indians call themselves *Ashiwi*, meaning "the flesh." With the Hopi of Arizona, these people retain more of their pre-Columbian culture than perhaps any other North American Indians. They are descendants of the people of ancient Cibola, first seen by Marcos de Niza in 1539; his glowing accounts of the Seven Cities of Gold spurred Francisco Vázquez de Coronado to visit them the next year. Spanish influence was strong until 1680, when the Zuni participated in the Pueblo Revolt; their aboriginal Pueblo culture has been dominant ever since that time.

The Zuni live by agriculture and are among the finest jewelry makers in the Southwest, being particularly noted for their mosaic work in shell, jet, and turquoise, all set in silver mountings. Formerly skilled in weaving and pottery making, they have allowed these arts to decline, with the result that almost no Zuni textiles or pottery are made today. Their magnificent costumed ceremonies, particularly the winter *Shálako* pageant, are familiar to many visitors and are equaled only by the Kachina and Snake dances of the neighboring Hopi. At the time of the 1680 revolt, the Spanish census reported a Zuni population of 2,500, which shrank to 1,400 following the epidemic of 1898-1899. Today the population at Zuni (q.v.), N.Mex., and its suburbs is over 3,500.

See also PUEBLO INDIANS; NEW MEXICO-7. *History* (Under Spain and Mexico).

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**ZUNI MOUNTAINS**, *zōō'nē*, mountain range, New Mexico, in Valencia and McKinley counties, on the Colorado Plateau, near the Arizona line, southeast of Gallup. The mountains comprise a domed uplift about 70 miles long and 30 miles wide. The highest peak is Lookout Mountain (9,110 feet). There are lava beds in the south and southeast portions of the range.

**ZÚNIGA Y AZEVEDO**, *thōō'nyē-gā ē ä-thā-vá'thō*, Gaspar de, CONDE DE MONTERREY, Spanish viceroy of Mexico and Peru; b. Andalusia, Spain, ?1540; d. Lima, Peru, Feb. 10, 1606. Having arrived in Mexico as viceroy on Nov. 5, 1595, he sent out exploration and colonization expeditions to Lower California in 1596 and to the present State of California in 1602, both under the command of Sebastián Vizcaíno (q.v.). He also organized an expedition under Juan de Oñate (q.v.) to conquer what is now New Mexico in 1598. Zúñiga was noted for his fair administration of the Mexican colony, his protection of the Indians,

and his colonizing efforts. Monterey, Calif., and Monterey Bay are named in his honor. In 1603 he was appointed viceroy of Peru and began his administration there in 1604.

**ZUNSER**, *tsōō'n'zar*, Eliakum, Yiddish bard; b. Vilnius, Lithuania, Oct. 13, 1836; d. New York, N.Y., Sept. 22, 1913. After a traditional Jewish education in Vilnius he came under the influence of *Maskilim* (Men of Enlightenment) and composed philosophic poems in Hebrew and singable lyrics in Yiddish. In 1856 he was impressed into military service but was released within a few months. In 1857 he found employment as a braider in Kaunas and studied at Rabbi Israel Salanter's moral academy, where students were encouraged to concentrate on eternal verities in silent meditation.

Zunser's early suffering, years of hunger, and lonely wandering gave him a rich fund of experiences and brought him ever nearer to the common people, and he became the most popular *badchan* (folk singer) of his day. Russian Jews were familiar with his melodies and texts even before his first volume, *Shirim khadoshim* (1861), had appeared. Thereafter his fame grew as a wedding bard, a chanting moralist who sermonized while he entertained and improvised appropriate verses during different stages of the ceremony. His drama *Mekhiras Yosef*, written in 1872, anticipated the rise of the Yiddish theater under Abraham Goldfaden. The Russian pogroms of 1881 led him to advocate emigration. For BILU, the first pioneers who set out for Palestine, he composed in 1882 his most famous songs—*Die Sokhe*, *Die Blum*, and *Shivas Zion*. He himself fled to America in 1889, where he continued as a singer of social justice in the New World and as the sensitive interpreter of Jewish martyrdom in the Old World.

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**ZUNZ**, *tsōōnts*, Leopold, German Jewish scholar; b. Detmold, Germany, Aug. 10, 1794; d. Berlin, March 17, 1886. He was the founder of the *Wissenschaft des Judentums* (science of Judaism), based on the application of modern scholarly research methods to the study of Jewish religion, history, ritual, and liturgy. His doctoral thesis *Etwas über die rabbinische Litteratur*, published in 1818, contained the outlines of what was at the time a completely new field of scholarly endeavor. In 1819 he became a cofounder of the Berlin Verein für Kultur und Wissenschaft der Juden and in 1823 editor of its journal. The society published his biography of Rashi, the medieval Bible and Talmud commentator. From 1826 to 1830 Zunz was head of the school of the Berlin Jewish Community, and from 1840 to 1850 principal of the Jewish Teachers' Seminary. His most significant book is *Die gottesdienstlichen Vorträge der Juden* (1832; The Synagogical Lectures of the Jews), considered to this day a classic work of research into the history of Jewish homiletics and exegesis. Among his other important works are a volume on the names of the Jews and several books on medieval Jewish liturgical poetry.

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## ZURBARÁN, thoor-bà-ràn,

painter; b. Fuente de Cantos, Estremadura, Spain, Nov. 7, 1598; d. Madrid, Aug. 27, 1664. Practically self-taught, except for an apprenticeship at 16 to a minor artificer of religious figures in Seville, Zurbarán nevertheless succeeded in becoming as a painter the mystic poet of the Counterreformation, as El Greco was its lyric dramatist. His major work (1629-1644), a contemplation of dissonances between the primal world of divine love and the elemental world of brute fact, begins with *St. Peter Nolasco Dreaming of a Heavenly Jerusalem* (Madrid); it includes *The Apotheosis of St. Thomas Aquinas* (1631; Seville), his most celebrated painting; *St. Hugh of Grenoble Visiting the Refectory* (1633; Seville); and *St. Francis Kneeling* (1639; London). In his late forties his considerable popularity yielded to Murillo's sentimental religiosities, and Zurbarán sacrificed his genius to do wholesale work for the vast South American market of church art, which frequently proved delinquent in payments. In 1658, deep in debt, he left Seville to join his friend Velázquez, who was court painter in Madrid.

Of Basque ancestry, Zurbarán combined a provincial mysticism with a fresh and direct observation of men and things, mindful of the hieratic intensity of Spain's most articulate and efficient saints, St. Ignatius of Loyola (*The Spiritual Exercises*) and St. Teresa of Ávila (*The Interior Castle*). His matchless paintings of monasticism rendered the internal and external aspects of the dedicated life in lateral movement, in contrast to the synopated spirals of El Greco. He placed monks and saints "half in and half out of doors," in the manner that Gertrude Stein disposed St. Teresa in *Four Saints in Three Acts* (1934), or he had them "laterally be lined," like the Jesuit followers of St. Ignatius in the Stein opera. He insisted on setting the rough, earthy look of things, their *bodegón* (tavern still life) values, in counterpoint to a sober architecture of form and a Venetian resonance of color. In his tenebrist canvases, shapes are at once settled to stay and ready to go. He is imperious with vermilion, blue, and gold, with rose and orange and manifold white; austere with Spanish blue-gray and blue-green hues; and sturdy with the blue-red slate of Spanish earth. Like Goya and Manet two centuries later, like Henri Rousseau and Picasso in the 20th century, he used the technique of applying colors at full intensity in order to achieve an archaic strength and plainness.

Zurbarán, like Michelangelo da Caravaggio, filled his pictures with darkness rather than with light, but he also added to the baroque a quality of profound meditation. In his portraits of starved and threadbare male saints, spirit assaults the sinews of the flesh; in his female saints, so elegant in silks and velvets, spirit redeems the ideals of the flesh. If the paintings of the male saints are prayers made palpable in the dark corners of desolation, the paintings of the female saints are like pagan temples transformed into Roman churches, such as Santa Maria sopra Minerva or Santa Maria in Cosmedin, once sacred to Mercury and Ceres. Examples of these paintings are the *St. Margaret* (1632; London), *St. Peter* (1633; Lisbon), *St. Simon* (1633; Lisbon), and *St. Apollonia* (1636; Paris).

In his work for the white-robed monastic orders Zurbarán, using impasted whites, achieved his subtlest inflections as a painter. The series of

scenes for the Carthusian monastery in Jerez (1637-1639; several in Cadiz Museum), the martyrdoms for the Mercedarian cloister in Seville (1636-1638; now scattered in private collections), and above all the 11 large and 10 small paintings for the Hieronymite monastery in Guadalupe (1638-1639) are accomplished in whites that are,



Taurg

The Apotheosis of St. Thomas Aquinas, by Francisco d Zurbarán.

by turns, hard as stone, soft as pith, heavy as frost, and always deep as the solitude of his subjects, "alone with the Alone." Their miraculous hush of whiteness, like a polar light, a cloud, an eagle feather, is a firm abstract of Zurbarán's art and mysticism. American museums with examples of his work include the Boston Fine Arts, Chicago Art Institute, Hartford Wadsworth Atheneum, New York Metropolitan, and San Diego Fine Arts. *The Holy House of Nazareth* (c. 1630) can be seen at the Museum of Art, Cleveland, Ohio; and one of his few portraits, the *Doctor of Laws* (c. 1658-1660), is in the Isabella Stewart Gardner Museum, Boston.

PHILIP RODDMAN.

**ZÜRICH**, tsü'ríkh, canton, Switzerland, bounded on the north by Schaffhausen and the Rhine River, which constitutes the border with Germany, and by the cantons of Aargau on the west, Zug on the south, and Thurgau and St. Gallen on the east. The area is 668 square miles. The Lake of Zürich, which forms part of the southern boundary, reaches north into the canton; the city of Zürich, the cantonal capital, lies at its north end. The land surface of the canton is rolling, cut by valleys of rivers that drain northwest to the Rhine, and the maximum elevation is less than 4,000 feet. Corn and other cereals and fruit are grown in cultivated regions, and there are some wooded areas. Manufacturing, primarily of machinery and textiles, is concentrated principally in Zürich and Winterthur. There are hydroelectric plants along



A view of Zürich, showing the Limmat River, which flows through the city into the Lake of Zürich.

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the Rhine. The people are chiefly Protestant and German speaking, and their laws and customs are Germanic. In earliest times, the lake valley was a migration route and later an artery of trade, and the easy contours of the land encouraged settlement. Conquests by the city of Zürich created the modern canton. It was admitted to the Swiss Confederation in 1351 and after a 10-year separation during an alliance with Austria, was readmitted in 1450. A new democratic constitution, with town and country on an equal footing, was adopted in 1869. Pop. (1960) 952,304.

**ZÜRICH**, city, Switzerland, capital of Zürich Canton, at the north end of the Lake of Zürich, on both sides of the Limmat River and a tributary, the Sihl, 60 miles northeast of Bern. The largest city in Switzerland, cosmopolitan in character, it is the principal center of industry, trade, banking, and travel, and fosters a vigorous intellectual life in its educational and cultural institutions. Its setting is attractive, with wooded hills around the valley, and on clear days the snow-capped Alps are visible down the lake. The city is a blend of ancient and modern, with fine old houses on both sides of the Limmat, which leaves the lake here, and broad streets and plazas bordered by office buildings and shops in the newer sections. Residences cluster along the lake below the Ütliberg, to the southwest, and the Zürichberg, to the east, while industry is concentrated in the northern part of the city. Manufactures include automobiles, radios, machinery, paper, woolen and silk textiles, chemicals, cement, canned products, beer, flour, and pastry. Printing and publishing are important. The Zürich International Airport is at Kloten, six miles from the city.

The University of Zürich and the Federal Institute of Technology draw many foreign students. The Swiss National Museum houses a distinctive collection of antiquities and historical material, and the Art Gallery is notable. The Protestant Cathedral, or Grossmünster, was built in the 11th to 13th century. St. Peter's Church and the Fraumünster date from the 13th century. In April is held the city's traditional festival, the *Sechseläuten*, with a procession of the guilds.

Lake dwellers, in pile-supported houses, were the earliest occupants of the city's site, and later there was a settlement of the Celtic Helvetii. The name is believed to derive from the Celtic *dur*,

meaning "water." Successive conquerors were the Romans (about 58 B.C.), the Alemanni (3d century A.D.), and the Franks, whose kings had a residence here. The medieval town became a free imperial city in 1218 and joined the Swiss Confederation in 1351. In the 16th century Zürich was the wellspring of the Swiss Reformation. Pop. (1960) 440,170.

**ZÜRICH, Lake of**, lake, Switzerland, bordered by the cantons of Zürich, Schwyz, and St. Gallen, about 25 miles long and up to 2½ miles wide, with an area of 34 square miles and a maximum depth of 469 feet. Near the east end a viaduct 1,017 yards long crosses the lake from Rapperswil on the north shore to Hurden on the south, carrying rail and road traffic. East of the causeway the lake is known as Obersee. At the east end the Linth River enters through the Linth Canal, which connects with the Lake of Wallenstadt. The Limmat River flows from the lake at the north end at the city of Zürich. Gentle hills covered with orchards, vineyards, and gardens surround the lake. Along the shore are many villages and villas and some industrial establishments. Southwest of Rapperswil lies the small island of Ufenau, where Ulrich von Hutten, satirical writer and supporter of Martin Luther, died in 1523 and is buried.

**ZÜRICH, University of**, an institution of higher learning in Zürich, Switzerland, founded in 1833. There are six faculties: divinity, law, medicine, veterinary medicine, arts, and science. Doctor's degrees are awarded, and a diploma (*Lizentiat*) is also obtainable in the faculties of law, arts, and science. The library contains about 1,200,000 volumes. There are some 60 student organizations, appealing to scientific, cultural, and social interests. Average annual enrollment is about 3,700.

**ZUTPHEN**, zút'fən (also ZUTFEN), town, the Netherlands, in Gelderland Province, in the northeastern part of the country, where the Berkel River meets the IJssel near the western end of the Twente Canal, 16 miles northeast of Arnhem. It is a dairy and lumber center, with some light manufacturing and plants processing meat and tobacco.

During the Middle Ages, when the IJssel was a trade artery between the Rhineland and the

North Sea, Zutphen was an important commercial center and a member of the Hanseatic League. Its commerce declined in the 16th century, when during the Dutch wars of independence it was twice captured by the Spaniards (1572, 1583) and its population massacred. The English poet and soldier, Sir Philip Sidney, was fatally wounded at Zutphen in 1586 while aiding the Dutch.

Zutphen is a town of winding streets and old gabled houses, with traces of its early fortifications remaining. The Gothic church of St. Walburga (Grote Kerk) was founded in 1105 and rebuilt after 1446. Its magnificently proportioned interior contains medieval frescoes, a baptismal font in copper (1527), and a 15th century Gothic chandelier. Adjacent is the library of the Grote Kerk; completed in 1564, it houses a collection of medieval books and manuscripts that are chained to reading desks as in the 16th century. The Stadswijnhuis, or city winehouse (1618-1627), is a reminder of Zutphen's former importance as an entrepôt for Rhenish wine export. Pop. (1957) 24,220.

**ZUYDER ZEE.** See ZUIDER ZEE.

**ZWEIBRÜCKEN**, tsvī'brük-an, city, Germany, in the State of Rhineland-Palatinate, on the Schwarzbach River, 54 miles southwest of Mannheim. The name means "two bridges." The city has machine, textile, wood, and shoe industries, an agricultural college, and a famous library (Bibliotheca Bipontina) with valuable old manuscripts (see BIPONT EDITIONS). During World War II, Zweibrücken was 86 percent destroyed, including the baroque Ducal Castle (1720-1730) and the Late Gothic Alexander Church (1493-1507). It was chartered as a city in 1352 and was the capital of the Duchy of Pfalz-Zweibrücken from 1410 to 1799. After World War II the city was included in the Federal Republic of Germany (West Germany). Pop. (1961) 32,900.

**ZWEIG**, tsvīkh, **Arnold**, German novelist and dramatist: b. Glogau (Pol. Głogów), Silesia, Nov. 10, 1887. He became known as a novelist with his sensitive *Novellen um Claudia* (1912; Eng. tr., *Claudia*, 1930) and as a dramatist with his *Ritualmord in Ungarn* (1914), revised as *Die Sendung Semaels* (1918). His World War I experiences in northern France and on the Russian front found expression in his cycle of prose epics *Der Streit um den Sergeanten Grischa* (1927; Eng. tr., *The Case of Sergeant Grischa*, 1927), *Junge Frau von 1914* (1931; Eng. tr., *Young Woman of 1914*, 1932), *Erziehung vor Verdun* (1935; Eng. tr., *Education Before Verdun*, 1936), *Einsetzung eines Königs* (1937; Eng. tr., *The Crowning of a King*, 1938), and *Die Feuerpause* (1954; *Armistice*). Most influential was the first, which was translated into many languages and paved the way for the still greater vogue of Erich Maria Remarque's war novels. The central character is an inarticulate, simple-minded Russian prisoner of war whose unimportant life and mistaken end challenged the entire Prussian system of administering justice.

An early adherent of Zionism, Zweig recorded his observations of the Jewish scene in the essays in *Galiban* (1927) and *Bilanz der deutschen Judenheit* (1934; Eng. tr., *Insulted and Exiled*, 1937) and in the novel *De Vriendt kehrt heim* (1932; Eng. tr., *De Vriendt Goes Home*, 1933). He was exiled from his Berlin home in 1933 be-

cause of his Jewish origin and settled in Haifa, Palestine. There, despite failing eyesight, he completed *Das Beil von Wandsbeck* (1946; Eng. tr., *The Axe of Wandsbeck*, 1947), a novel depicting Nazi terrorism. He was unable to adjust to Palestinian realities, however, during the strife-torn years that preceded Israel's independence, and returned to East Berlin in 1948. There he served as president of the Academy of Arts in 1949-1952. He died in East Berlin on Nov. 26, 1968.

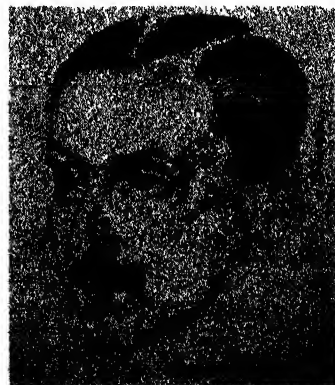
Zweig's later works include *Five Romances* (1959); a volume of poems, *Jahresringe* (1963); and *Essays I and II* (1959, 1967). He was awarded the Lenin Peace Prize in 1958.

SOL LEITZIN,  
Author of "A Historical Survey  
of German Literature."

**ZWEIG, Stefan**, Austrian writer: b. Vienna, Austria, Nov. 28, 1881; d. Petrópolis, Brazil, Feb. 23, 1942. Offspring of a patrician Jewish family, he was educated at the universities of Berlin and Vienna and began his career with the lyric volumes *Silberne Saiten* (1901) and *Die frühen Kränze* (1907). Travels in Africa, Asia, and America gave him world perspective. In the circle of the Belgian poet Émile Verhaeren, whom he translated into German, he came in contact with the literary elite of western Europe and projected for himself the role of the "good European," the sympathetic intermediary between the cultures and great personalities of the Continent. He drew upon Hellenic sources for his first drama *Tersites* (1907) and upon Biblical sources for his pacifist play *Jeremias* (1917), which warned against the folly of war and comforted the defeated. His short stories followed the contemporary tradition of "Young Vienna" and were especially influenced by Arthur Schnitzler and Sigmund Freud.

Zweig reached the height of popularity with his biographies and cultural essays. His studies of Dostoyevsky and Tolstoy made the Russian soul more intelligible to the West. In Romain Rolland, Honoré Balzac, Stendhal, Joseph Fouché, and Marie Antoinette he sought to interpret the French soul. In other studies he appraised sympathetically the achievements of diverse peoples and ages. He adapted Ben Jonson's *Volpone* for contemporary audiences and wrote opera librettos for Richard Strauss. Deprived of his home in Salzburg and forced into exile because of his Jewish origin, he was unable to establish new roots and committed suicide in Brazil. His autobiography *Die Welt von Gestern* (1941; Eng. tr., *The World of Yesterday*, 1943) affords keen in-

Stefan Zweig



Brown Brothers

sight into his personality and the European culture of his generation.

SOL. LIPTZIN.

**ZWICKAU**, tsvik'ou, city, Germany, on the Zwickauer Mulde River, 40 miles south of Leipzig. Its industry is based on rich coalfields nearby. There is also manufacturing of small motor cars, textile goods, dyes, chemical products, and ceramics. Zwickau has an Institute of Technology with a special Department of Mining. Its historic buildings include the Church of St. Mary (Marienkirche), dedicated in 1118, altered in the Late Gothic style in 1505-1537, and containing a painting of Christ by Lucas Cranach the Elder; St. Catherine's Church (Katharinenkirche), begun in 1212 and rebuilt in Late Gothic style; the City Hall (Rathaus), of the 15th century; and the Late Gothic Gewandhaus (Clothworkers' Hall), built in 1522-1536, part of which has been converted into a theater. The Oberstein Castle (1565-1585) has been turned into a penitentiary.

Zwickau was first mentioned in 1118 and was a free imperial city from 1290 until 1323, when it was taken over by the margraves of Meissen. It was famous for its silver mines after 1470, and for its Latin college. The Anabaptist movement of the German Reformation was founded by Thomas Münzer in Zwickau in 1520 (see ANABAPTISTS). The city was the birthplace of the composer Robert Schumann (1810-1856). After World War II Zwickau was included in the Karl-Marx-Stadt district of East Germany. Pop (1979 est.) 123,475.

**ZWINGLI**, tsving'le, Ulrich (or Huldreich), first Protestant reformer of Switzerland: b. Wildhaus, St. Gallen Canton, Switzerland, Jan. 1, 1484; d. Kappel am Albis, Zürich Canton, Oct. 11, 1531. The third of eight sons of a comparatively well-to-do bailiff, he was designated by his father at an early age for a career in the church. He studied in Basel, Bern, and Vienna and completed his training in the arts and in theology at Basel (1502-1506), where he obtained the degree of M.A. He was already a persuaded humanist when in 1506 he was called upon to serve as parish priest of Glarus. There Zwingli turned to Biblical studies, reading the New Testament in Greek and carried on a valued correspondence with Erasmus. He gradually came to regard himself as an Erasmusian.

He also began to think that the church should be reformed by a restoration of its original order. Yet he was a faithful churchman, loyal to the pope. As such he served as chaplain to the

young men of Glarus who had engaged as mercenaries for the pope in defense of northern Italy against the French, and was present at the victory of Novara in 1513 and the defeat of Marignano in 1515.

In 1516 Zwingli became preacher in the convent of Einsiedeln, then as now a celebrated place of pilgrimage, and began to give public expression to his ideas of reform of the church upon those points in which he believed it had departed from the primitive teaching. He gained considerable fame as a pulpit orator, so that in 1518 the chapter of the Grossmünster (cathedral) of Zürich invited him to become the people's priest (preacher) there. He assumed his new duties in January 1519 and delivered a series of sermons in which he expounded seriatim entire books of the New Testament, beginning with the Gospel according to Matthew, hoping to instill in his hearers the desire for a reform of the church and the common life according to the pattern of the New Testament. A little later, he began to object to the efforts of foreign agents to secure popular support for the recruitment of Switzerland's young men as mercenaries, and did not hesitate to inveigh against papal policies in this connection. In December 1518 he came under the influence of Martin Luther's early writings and the next year became a partisan of Luther's cause, both in respect to the new understanding of the Gospel in terms of trusting faith in the divine promise of forgiveness and in respect to the criticism of the papacy as an enemy of Christ.

**Reformation in Zürich.**—Under Zwingli's leadership, Zürich gradually became a second center of the Reformation, next to Wittenberg. This was possible only because Zwingli had secured the government's support for his enterprise. In 1520 the Zürich Council published a decree ordering that the Holy Scriptures should be taught "without human additions." In 1522 Zwingli began to abolish Roman Catholic ceremonies and wrote a treatise against fasting.

The government issued a call for a "disputation," a public discussion by theologians and churchmen, to test the truth of Zwingli's teachings. Zwingli prepared 67 *Schlussreden*, or proofs, in which he set forth his program for the reform of the church. On Jan. 29, 1523, the disputation took place, with Johannes Faber, vicar-general of the bishop of Constance, as the most prominent Roman Catholic representative. Faber refused to discuss any of Zwingli's propositions except the last, which denied the supreme authority of the hierarchy of the church. The Council decreed that Zwingli had not been convicted of error. On Oct. 26-28, 1523, a second disputation was held, as a consequence of which the Roman Catholic order in Zürich was gradually abolished. The monasteries were closed; ecclesiastical funds and properties were assigned to educational purposes and poor relief; and jurisdiction over marriage and divorce was assigned to a special court. By Easter 1525 the Mass and all other Roman Catholic sacraments and ceremonies were abolished and replaced by a preaching service and the simple observance of the sacraments of Baptism and the Lord's Supper according to the pattern of the New Testament.

Zwingli interpreted the Lord's Supper as a memorial feast, by the observance of which Christian believers, assembled as a local congregation, affirm their faith in Christ and renew their fealty to him. He denied the real presence of Christ in



Ulrich Zwingli

The Bettmann Archive



the bread and wine of the Eucharist and rejected the doctrine of transubstantiation. He affirmed a spiritual presence of Christ in terms of the sixth chapter of the Gospel of John. Zwingli set forth the theological reasons for all these innovations in his main theological work, characteristically entitled *Commentarius de vera et falsa religione* (1525; Commentary on True and False Religion). His doctrine was marked by a distinctive emphasis on the sovereignty of God, in connection with which he tended to view the Bible as the "Word of God" in a legalistic way. Moreover, he taught the doctrine of predestination as the basis and source of salvation, and he interpreted all forms of life as manifestations of God's providence.

**Opposition to Zwingli.** Zwingli encountered opposition from several quarters—from the Anabaptists, the Lutherans, and the Roman Catholics. The Anabaptists, who came publicly to the fore in Zürich for the first time late in January 1525, were originally followers of Zwingli, but they felt it necessary to part company with him because of his advocacy of a theocratic church order; they regarded his alliance with the political authorities of Zürich as irreconcilable with Christian teachings. Another controversy in which he became involved was due to the fact that his conception of the Lord's Supper called forth vehement opposition on the part of Luther, who, though rejecting transubstantiation, ardently believed in the real presence of Christ in the elements of the Lord's Supper. In the interest of forming a united evangelical front against the Roman Church and her political defenders, especially the Habsburgs, a colloquy was arranged at Marburg on Oct. 1–3, 1529, under the auspices of Philip, landgrave of Hesse. Luther, Zwingli, and the other Protestant theologians present readily agreed on the main Christian doctrines but found it impossible to achieve a common mind on the Lord's Supper.

The third major conflict in which Zwingli was involved was with the Roman Church and especially with its defenders in Switzerland. The five oldest cantons of the Swiss Federation, the so-called Forest (rural) Cantons, adhered strictly to Roman Catholicism and objected to the spread of the Reformation in the urban cantons. Under the leadership of Zwingli, Zürich imposed political and economic sanctions on the old cantons, and in the fall of 1531 they made a surprise attack on the city. Zwingli went to battle as a chaplain with the Zürich soldiers and was struck down in the fighting at Kappel am Albis, in Zürich Canton, on Oct. 11, 1531. His cause was taken up by his followers, and his work was carried on by his successor, Heinrich Bullinger.

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**Further Reading:** Christoffel, R., *Zwingli, or the Rise of the Reformation in Switzerland* (Gordon Press 1977); Gabler, Ulrich, *Huldrych Zwingli*, tr. by R. C. Critch (Fortress Press 1986); Jackson, Samuel M., *Huldreich Zwingli*, 2d rev. ed. (1901; reprint, AMS Press 1975); Potter, G. R., ed., *Huldrych Zwingli* (St. Martin's Press 1978); Stephens, W. P., *The Theology of Huldrych Zwingli* (Oxford 1985).

**ZWITTERION**, tsvit'ər-i-ən (from Ger. *zwitter*, hybrid, + *ion*), an electrically neutral organic molecule that has a positive charge at one end and a negative charge at the other. A zwitterion, also called dipolar ion, hybrid ion, or amphion, thus has an electric dipole moment. Amino acids and proteins often exist in the form of zwitterions.

One of the simplest examples is the amino acid known as glycine,  $\text{NH}_2\text{—CH}_2\text{—COOH}$ . In aqueous solution the  $\text{—COOH}$  (carboxyl) group at one end of the glycine molecule dissociates:  $\text{COOH} \rightarrow \text{CO}_2^- + \text{H}^+$ . At the other end of the molecule the  $\text{—NH}_2$  (amino) group acquires a hydrogen ion:  $\text{NH}_2 + \text{H}^+ \rightarrow \text{NH}_3^+$ . This results in the zwitterion  $^+\text{NH}_3\text{—CH}_2\text{—CO}_2^-$ . In the crystalline form of glycine the hydrogen of the carboxyl group is transferred to the amino group, so that the zwitterion also exists in the solid state. The dipole moments of zwitterions can be measured with appropriate equipment.

**ZWOLLE**, zvól'ə, town, the Netherlands, capital of Overijssel Province, in the north central part of the country, at the junction of the Zwartewater River and Overijssel Canal, 18 miles north of Deventer. It is a market town and railway and highway junction, and produces chemicals, metalware, clothing, edible fats, and dairy products.

Although the town dates from 1040 and received its charter in 1233, it did not become commercially important until the beginning of the 16th century. It was a leading Dutch stronghold during the wars of independence (1568–1648), but its defenses were destroyed in 1674 by the bishops of Münster and Cologne, allies of Louis XIV of France. The old star-shaped fortifications have been converted into parks, outlined by canals that occupy the moats.

During the Middle Ages, Zwolle was a cultural center, with famous convents and a celebrated school. On nearby Agnietenberg was a monastery where Thomas a Kempis (q.v.) lived from 1407 until his death. Many 15th and 16th century buildings have survived, among them the Gothic Grote Kerk (cathedral), the town hall, and the Sassenpoort, a high gateway with four octagonal towers. Pop. (1980) 82,190.

**ZWORYKIN**, zwōr'i-kin, Vladimir Kosma (1889–1982), Russian-American engineer. He was born in Murom, Russia, on July 30, 1889. As a student at the Institute of Technology in Petrograd (Leningrad), he became fascinated with the possibility of creating a practical television system. After the Bolshevik Revolution in Russia, he moved to the United States in 1919 and became a citizen in 1924. After some years with the Westinghouse company, Zworykin became a research scientist for the Radio Corporation of America (RCA) in 1929. He is the inventor of the iconoscope, the first practical "pickup" tube for television, and he directed the research that led to the development of the kinescope. He was also instrumental in perfecting the electron microscope, one of the most powerful tools of medical and biological research. In 1957 he patented a device that utilizes ultraviolet light and television to permit a color picture of living cells in action to be thrown upon a screen, opening new possibilities for biological research. He retired as director of electronics research for RCA in 1954 with the title of honorary vice president and continued to serve as a consultant. In 1966 he was awarded the National Medal of Science. He died in Princeton, N.J., on July 29, 1982.

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**ZYGOTE**. See EGG; EMBRYOLOGY; FERTILIZATION; REPRODUCTION.

